

AbstractID: 13821 Title: Water equivalent thicknesses of materials in protons, helium, carbon and iron ions

Purpose: To test analytical formulas previously developed for proton beams for their ability to calculate water equivalent thickness (WET) for materials in beams of helium, carbon and iron ions, and to compare the calculations to measured data.

Method and Materials: The methods for calculating the WET values were developed for proton beams, using theoretical range-energy relations. Those analytical formulas were used in this study to calculate WET values of materials in other heavy charged particle beams. Experimentally measured beam ranges and WET values from an iterative numerical method were compared with the WET values calculated by the analytical formulas. The measurements of WET values of various materials in proton beams were performed at the Midwest Proton Radiotherapy Institute. The measurement of water equivalent ratio (WER) values of materials in beams of protons, carbon and iron ions were taken from the literature.

Results: The differences between the values of WET calculated using analytical formulas and the numerical method were less than 1 mm in most cases, and differences between the analytically predicted results and the measured data were less than 1 mm in most cases as well.

Conclusion: The analytical formulas originally developed for proton beams can also be used to calculate WET values for helium, carbon and iron ion beams with good accuracy. This finding is useful because of the increasing use of heavy charged particle beams for cancer treatment and the need for accurate predictions of WET values of materials used in those therapies.