Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

A Universal Scaling of Proton Energy Deposition in Biological Materials[1] DAN FRY, WILFRED SEWCHAND, JOHN O'CONNELL, Walter Reed Army Medical Center, Radiation Oncology, Washington, DC 20307 — We have used GEANT 4.7.0 to simulate the dosimetric properties of various materials. Bragg curves for monoenergetic pencil beams with incident energies ranging from 70 MeV to 250 MeV have been characterized by the width (90%-10%) of distal and lateral edges, peak-to- entrance dose ratio, and FWHM. In all materials ionization by primary protons is the dominant energy loss channel. Energy loss by electrons and secondary protons is approximately an order of magnitude lower and dose from all other secondary particles is three orders of magnitude lower. We have found that a single scaling factor (material density) is most inadequate for fully defining the characteristics of the percent depth- dose distribution. However, the distal and lateral edge widths and FWHM can be universally scaled by scaling the proton beam energy by a material dependent factor. In addition, when the peak-to- entrance dose ratio is scaled by the stopping power ratio S_w relative to water, energy deposition properties of all materials appear to behave alike. Our results suggest that knowledge of the incident proton energy and effective Z of the target are sufficient to fully predict the depth-dose distribution irrespective of material type.

[1]This work was supported by the US Army Medical Research and Materiel Command under Contract Agreement No. DAMD 17-W81XWH-04-2-0022. Opinions and conclusions are those of the authors.

Dan Fry
Walter Reed Army Medical Center, Radiation Oncology, Washington, DC 20307

Date submitted: 29 Nov 2005 Electronic form version 1.4