Lecture 3.2b Unclear Points:

In the table on pg. 30, on the first rows concerning scatter and dose, are you referring to "percentage surface dose" or the actual dose when you say "surface dose"?

Percentage surface dose

A photon beam experiences exponential attenuation in an absorber and thus the intensity decreases but never goes to zero... except photons by definition are discrete packets of energy, so once intensity becomes <1, wouldn't it effectively become zero?

Exponential attenuation is a deterministic relationship requiring a large number of photons. The individual photon interactions are stochastic and discrete.

Does surface dose refer to the dose at a depth right beneath the surface or at the surface itself?

Dose always means to a small volume.

I understand that to determine range we use the total stopping power and to determine dose we are interested only in the collisional stopping power. However, the radiative stopping power produces bremsstrahlung that will eventually deposit energy. Shouldn't that be taken into account in the total dose delivered?

Dose arises from ionizations, which are related to collisional stopping power.

I'm confused about why the low energy electron beam has a sharper fall-off than high energy beam in Dose Vs. Depth plot.

Lower energy has less range straggling.

When you say less scatter leads to "higher percent surface dose", you are saying that surface dose is closer to the maximum dose throughout the range for high energies than for low energies. What trends can we state about the actual surface dose between high energy and low energy beams?

Surface dose is closer to maximum dose for higher energy beams because of less scatter. Can't predict a priori what that surface dose is, other than via Monte Carlo calculations.

Why are we only interested in collisional stopping power to determine dose?

Collisional interactions deposit energy locally; radiative interactions, giving rise to Bremsstrahlung, deposit energy at a distance.

I'm a little confused as to what the difference is between depth and path length; I had assumed the two were synonymous, but question 4 leads me to believe otherwise.
Depth is physical depth inside patient or phantom; path length is line along track of charged particle. For protons, depth and path length are virtually synonymous because of absence of scatter, whereas for electrons, which exhibit a large amount of scatter, depth and path length are different.

For the example where we calculated the range by averaging the stopping power over an interval and adding all the ranges for many intervals, does the size of the interval affect the calculation? We started with an interval from 10 - 4 MeV and ended with an interval of 0.1 to 0.01 MeV. Does the actual size of the intervals matter?

Depends on the relative change in stopping power with energy. Once you get beyond around 4 MeV, the change is negligible, so we can use the entire interval.

The electron dose versus path length curve is really not a good description of the electron dose versus depth. The depth is not really path length at all. I am still not very clear about this, please explain.

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