Optical Methods in Diagnosis

2nd semester, 2015-2016

Homework #6

We will determine photon absorption distribution for laser beams with finite diameters. Use the same parameters as Homework #5: $\mu_a = 6$ cm^{-1}, $\mu_s = 414$ cm^{-1}, g = 0.91, Henyey-Greenstein phase function, n_1(outside medium)=1, n_2(tissue)=1.37, $\Delta r = \Delta z = 0.1$ mm.

Plot the fluence rate (W/cm^2) distribution in the tissue (radius = 3 mm, thickness = 1.5 mm) for a collimated beam that has (A) a uniform distribution with a radius of 0.5 mm and irradiance = 1 W/cm^2, and (B) a Gaussian distribution with an e^{-2} radius of 0.5 mm and total power of 7.85 mW. Use variable-weight photons. Choose one of the following approaches:

Method 1: Distribute input photons over area of the incident beam

Modify your code “x = y = z = 0” to “z = 0, x = function (r.n.), y = function (r.n.)” for initial photon positions.

Method 2: Convolve impulse response with the radial profile of the incident beam

After completion of Monte Carlo for the impulse response (initial position x = y = z = 0), use a sub-program to compute the convolution of the impulse response and the source radial profile.