AbstractID: 2757 Title: Monte Carlo study of the effect of the tissue composition on the dosimetric data used for low energy photons.

Purpose: Low energy photon isotopes like Iodine-125 or Palladium-103 are widely used for brachytherapy applications, as in the treatment of prostate, eye or very recently breast. The mean energy is approximately 30 keV for Iodine-125 and 20 keV for Palladium-103. In the vast majority of brachytherapy treatment planning the patient is still considered as an infinite water phantom. The real compositions of the tissues, the presence of heterogeneities or the real shape of the body are not taken into account. In this work we used Monte Carlo techniques to estimate the impact of those approximations on the calculations of the dose distributions in the patient.

Method: The radial dose functions were calculated for IBt seeds using MCNP4C in different situations and in different materials including different body tissues whose compositions were taken from ICRU44[1]. For these calculations, MCNP4C default cross section library was modified to match EPDL97[2].

Results: The differences between radial dose functions calculated in muscle and in water can be as high as 15% at 5 cm for ^{103}Pd and 10% at 5 cm for ^{125}I. For breast tissue the comparison with water shows an underestimation of the radial function of up to 50% at 5 cm from a ^{103}Pd seed. The same calculations in lens tissue show on the contrary a good agreement with the radial dose function calculated in water. Moreover, due to photoelectric absorption, we show that the presence of even very limited amount of high Z elements as heterogeneities or as component of the tissue has an effect on the radial dose function and so on the dose distribution around the seeds.

Conclusion: The real composition of the body tissues should not be neglected because of the large influence of high Z elements due to the high photoelectric cross section for low energy photons.