AbstractID: 5255 Title: Measured and calculated dose distribution around ¹²⁵I brachytherapy seeds in a breast phantom

Purpose:
To compare measurement with Gafchromic® EBT films and Monte Carlo (MC) calculations of the dose distribution around LDR brachytherapy ^{125}I seeds in a breast phantom and to analyze the effect of tissue elemental composition.

Method:
MC simulations of IBt Interseed^{125} seeds were performed, using MCNP4C. In view of the low energy of the photons, the detailed physics treatment was used, with libraries from EPDL97 and no electron transport. In order to evaluate the perturbation of the film, simulations were carried out to compare the dose distributions in the film and in water or acrylic. The radial dose function of tissues and potential substitutes were determined using MC and compared to associate the best substitute to the desired tissue. Measurements for 5 seeds in an acrylic breast phantom were performed and compared with the MC simulations for the same geometry.

Results:
Our simulations show no significant differences between dose distributions calculated in films and in water (average difference 0.13%). Similar results can be observed for simulations in acrylic. The radial dose function of acrylic is very close to the one of breast tissue (2/3 mammal gland, 1/3 fat). However, there is a significant difference in the dose distributions in acrylic and water (average 7%, maximum 25%). The comparison between the measurements in the acrylic phantom and the calculations shows a good agreement between the isodose distributions (within 12%).

Conclusion:
Both in water and in acrylic, EBT films appear to introduce no significant perturbation to the measured dose distribution around ^{125}I LDR brachytherapy seeds. These films are very useful tools for measurements around ^{125}I seeds. There is a significant tissue composition effect that should be taken into account in LDR brachytherapy dosimetry. Acrylic appears to be the best substitute for breast tissue.

Seeds furnished by IBt.