AbstractID: 3148 Title: Dose perturbation effects in brain implant brachytherapy with I-125 radioactive seeds

**Purpose**: Use Monte Carlo simulations to determine the dose perturbation effects of a single column of radioactive seeds implanted in the brain.

**Material and Methods**: The EGSnrc Monte Carlo simulation code together with an EGSnrc user code (BRACHYDOSnrc) was used to investigate dose perturbation effects in brain implant brachytheray using $^{125}$I. Dose perturbation effects resulting from the mutual attenuation or shielding of other seeds in the implant consisting between 8 and 12 seeds were investigated. The dose perturbation effects were calculated as the difference between the full Monte Carlo simulations taking into account the inhomogeneity caused by the presence of the seeds and the single seed superposition model which ignores the perturbation caused by other seeds in the implant. The seeds were arranged in a single column in a Perspex tubing (end-to-end) and calculation medium was water.

**Results:** The results show that for $^{125}$I. seeds implanted into the brain, with no spacing between seeds, the single superposition dose calculation models underestimates the dose along the longitudinal direction of the seeds by up to 20%. The shielding effects of other seeds causes the dose perturbation which occur generally in the longitudinal direction of the seeds. The volume occupied by the difference in the dose distribution between the full Monte Carlo simulations and simple superposition model increases with increasing number of seeds as expected. The differences in the rest of the calculation grid was generally with ± 5%.

**Conclusions** The differences between the full Monte Carlo simulations and the single seed superposition dose calculation is not clinically significant as differences occur close to the column of seeds where the dose is already high.