AbstractID: 12795 Title: On the search of the ideal radiation source for gold nano-particle enhanced radiation treatment

Purpose: The efficacy of the dose deposition from X-rays due to the use of high-Z materials is dependent on the energy of the radiation used. This paper attempts to select the optimal source for a gold nano-particles.

Methods: A general purpose monte carlo code (MCNPX2.7b) is combined with a code describing radiobiological damage (MCDS) yielding densities of double and single strandbreaks in cellular material. Using different external sources with a minimal energy spread, the densities of radiobiological damage is determined. In addition the energy spectrum and source of depositing electrons is determined, differentiating between fluorescent, Compton, knock-on, and Auger electrons. Particular interest is focussed
on the K-edge of gold.

Results: Efficiency at very low energies (10-20keV) seem to be the highest. Contrary to expectations the K-edge only yields limited increase in radiobiological efficiency. Some increase is found relative to energies just below the K-edge. A relatively large dose enhancement is noticed, which is seen to be highly dependent on the concentration of the contrast agent. Seeing that lower energies have an increased enhancement and biological effect, the effect of low energy sources like Iodine-125 and the Xoft electronic brachytherapy source spectra were used to provide the same information.

Conclusions: Xoft and I125 brachytherapy sources have a relatively high yield in Auger electrons compared to external sources, while having a comparable dose enhancement. The calculations however, were hampered due to the lack of good modelling for low-energy electrons, yielding large uncertainties.