AbstractID: 10505 Title: Monte Carlo simulation of dose distribution around 198 Au nanoparticles: a preliminary study for treatment quality criterion

Purpose: To simulate dose distributions around gold-198 nanoparticles using the Monte Carlo method and study the relation between nanoparticles concentration and dose homogeneity in a tissue. **Method and Materials:** ^{198}Au nanoparticles with 500 nm of radius immersed in a water phantom were simulated with PENELOPE Monte Carlo simulation code. The spatial resolution in the simulations wasset to 0.32 μm. Gold K-edge decay (80.7 keV), L1-edge decay (14.7 keV), L2-edge decay (13.4 keV) and L3-edge decay (12 keV) energies were simulated individually. A volumetric dose distribution around the Au particle was obtained and percentage depth dose curves and relative 2D and 3D maps were achieved. Using standards for large radiation field treatments, the region of 80% dose was found to define a dose penumbra region. The necessary distance between adjacent nanoparticles distributed in a tissue was studied to result in a homogeous distribution for each energy decay. **Results:** The percentage depth dose curve related to K-edge energy showed a buid-up region of 120 nm (reference to the center of the nano-sphere) and 1% dose at a 3.5 cm from the source. To the L1-edge, L2-edge and L3-edge energies the the 1% dose was found at 1.7 cm, 1.6 cm and 1.5 cm respectively. The distances between particles necessary to achieve dose homogeneity in water are 1.0 cm, 0.7 cm, 0.6 cm and 0.5 cm, respectively to K-edge, L1-edge, L2-edge and L3-edge. The nanoparticles concentration when the L1-edge is used is 42% grater then when the K-edge emission is used. The same relations calculated to L2 and L3 relative to the K-edge are similar. **Conclusions:** Monte Carlo simulation is an accurate instrument to study dose distributions around nanoparticles and provides data to define a homogeneity criteria for treatments.