AbstractID: 9239 Title: The secondary electron distribution of goldnanoparticle in proton therapy

Purpose: we simulate the secondary electron distribution qualitatively in low energy (0.1~5 MeV) proton irradiation on single gold nanosphere and nanorod separately. A preliminary dose enhancement of gold nanoparticles (NPs) in proton therapy is also performed.
Method and Materials: Three scenarios were studied. First one, proton beams were used to irradiate nanosphere with diameter of 100 nm. The beams passed through the center of NP. Only 10 protons were tracked for visualization in this case. The second one was similar to the first one except protons shooting the surface. In the third one, 100 protons shot nanosphere with diameter of 50 nm and nanorod with diameter of 10 nm and length of 100 nm individually. Beside this, we simulated a proton therapy in clinical use. The concentration of 7.5% gold nanosphere solution was mounted in water phantom.
Results: 1), if the proton energy is less than 0.5 MeV, elastic scattering and electron capture are dominant. If the proton energy is higher than 1.0 MeV, ionization is dominant and more secondary electrons are generated in nanosphere. 2), if the proton beam shoot the nanosphere surface region, most secondary electrons will go out side the NP. 3), nanrod is more effective to produce secondary electrons than nanosphere. 4), about 20% dose enhancement was observed in one proton therapy lab where proton mean energy is 63.5 MeV.
Conclusion: In the low energy gold NP proton therapy, a lot of secondary electrons are produced. This motivated us in doing similar study in higher energy proton cases. The enhancement in dose and RBE around NP is possible in proton therapy.
Conflict of Interest (only if applicable): N/A