

## AbstractID: 11122 Title: Monte Carlo simulation for nanoparticle-enhanced irradiation in small animals

**Purpose:** Report our computer simulation investigation on the nanoparticle-enhanced irradiation for small animals in the hardware settings of a commercial micro CT imaging system.

**Method and Materials:** PENELOPE, a Monte Carlo radiation transport code, was used in our simulation study. Three identical cylinder-shaped water phantoms were created with diameter of 1.0 cm and length of 3.0 cm. An analytical ball-shaped tumor with diameter of 1.0 mm was embedded at the center of each phantom. The first tumor model was filled with water. The second and third tumor models were filled with homogeneous mixtures of gold and magnetic nanoparticle solution separately. The geometrical scanning settings of a commercial micro CT (Skyscan 1076) were simulated in the irradiation model. The distance was 12.1 cm from the irradiation source to rotation center and 5.1 cm from the rotation center to detector. A variety of photon energies were simulated as the irradiation source, including 30, 50, 100, 150, 300, 500 KeV, and 1 MeV.

**Results:** For larger photon energies including 300, 500 KeV and 1 MeV, dose built-ups and penumbras were observed in the percentage depth dose curves and lateral beam profiles. Maximum dose occurred in the tumor region in the second and third tumor models for all energies. The lateral beam profiles show that all the maximum dose levels in the second and third tumor model are greater than the first model. This key finding suggested that nanoparticle based solution can be used as the dose-enhanced agent.

**Conclusion:** Percentage depth dose curves and lateral beam profiles were computed for different phantoms, including tumor models filled with different nanoparticle solutions. Nanoparticles had been previously shown to be the excellent imaging contrast medium and our simulation study indicated that nanoparticles can also be applied as an effective dose enhanced agent in small animal irradiation.