

## AbstractID: 11114 Title: Monte Carlo simulation for small animal irradiation in micro CT settings

**Purpose:** Report our computer simulation investigation on the small animal irradiator 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. Two identical cylinder-shaped water phantoms were created with diameter of 1.0 cm and length of 3.0 cm. A simulated 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 and second was filled with a homogeneous mixture of Conray solution. Conray is iodine based sterile aqueous solution and used as the contrast agent in clinical applications. The geometrical irradiation settings of a commercial micro CT (Skyscan 1076) were modeled in the simulation. 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 higher 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 tumor models for all energies. The lateral beam profiles show that the maximum dose in the second tumor model is greater than the first model. This key finding suggested that iodine based solution can be used as the dose-enhanced agent for small animal irradiation.

**Conclusion:** Percentage depth dose curves and lateral beam profiles were computed to quantify the various photon beam characteristics. Small animal irradiation facility is a final missing piece in the grant integrative molecular imaging map. Our simulation results can serve as the prior recommendations toward the optimized small animal irradiator hardware development.