

AbstractID: 5160 Title: The Small Animal Radiation Research Platform: Benchtop Cone-Beam CT

Purpose

We are constructing a benchtop small-animal radiation research platform to deliver focused, conformal radiation for translational research. An x-ray tube is employed for both irradiation and cone-beam CT imaging. This paper reports on the design and initial results of an integrated cone-beam CT sub-system to provide image guidance prior to radiation treatment delivery.

Materials and Methods

The design of the platform necessitates cone-beam acquisition with a unique geometry in which projection images are acquired as the animal is rotated about an anterior-to-posterior axis. In these prototype experiments, images of a euthanized mouse were acquired (1 image per degree for 360°) using a phosphor-mirror-coupled CCD camera and with the x-ray tube operating at 80 kVp. We perform cone-beam CT reconstruction via the filtered back-projection algorithm of Feldkamp et al.

Results

This system produces high-quality CT reconstructions with isotropic resolution and minimal artifacts. Soft-tissue contrast is easily visualized. Reconstruction time is approximately 3 minutes. The acquisition requires approximately 22 cGy dose to isocenter. Work is ongoing to reduce the dose with the use of a higher DQE flat-panel imager, to optimize imaging parameters using the constant voltage x-ray beam, and to automate acquisition and reconstruction.

Conclusions

High quality CT reconstructions are possible with our prototype small animal system. In conjunction with robotic motion stages, the novel acquisition geometry enables the construction of a benchtop system in which the x-ray tube is used for both on-line CT acquisition and radiation delivery.