AbstractID: 13943 Title: Implementation of a Small Animal Image Guided Microirradiator: The microIGRT.

Purpose: Implementation of a conformal small animal image guided microirradiation therapy instrument (microIGRT), consisting of a cone beam microCT subsystem for submillimeter low dose structural imaging, image guided radiotherapy, and orthovoltage conformal microirradiation with high dose rate and high throughput.
Method and Materials: The microCT subsystem is based on an 80kVp micro-focus x-ray source with 75x75 μm^2 focal spot and a flat panel amorphous silicon detector with 1024x1024 pixels. The irradiator consists of a high power commercially available 320 kVp orthovoltage source with a 0.4x0.4 mm^2 focal spot that can be operated at a nominal power of 800W. The beam characteristics are controlled with two variable jaws used to pre-collimate the radiation beam along each orthogonal direction. An aperture exchange mechanism is used to conform the beam cross section by using computer generated apertures. The microCT radiation dose, the orthovoltage source spectral output, and dose rate are under evaluation using a mouse digital phantom and a pencil beam algorithm.
Results: CT imaging with micrometric resolution is achievable using 128 projections and a maximum radiation dose of 2cGy. Automatic animal positioning and handling is performed within sub-millimeter precision. The treatment beam can be aimed at different latitude and longitude angles and translated with 500 μm steps. The source was tested to deliver a radiation dose rate of 20 Gy/min when is filtered to a half-value layer of 4.6 mm Cu.
Conclusion: We present our progress and initial tests of a highly conformal image guided small animal microirradiator.