Purpose:Implementation of a small animal phase contrast computed tomography scanner to obtain high resolution small animal anatomical images at dose levels that are acceptable for radiobiological preclinical experiments.
Methods: The scanner is constructed using a micro focus x-ray source, a rotating small animal bed, and high resolution amorphous silicon detector. The x-ray source is a 50 W, 80kVp micro focus x-ray source with a 10x10 um2 focal spot. The animal bed consists of a rotating base supporting a small animal holder and non-rebreathing isoflurane anesthesia delivery system. The final component is a flat panel detector with 2048x1024 pixels with a pixel size of 48 um. The detector is mounted on two linear stages orthogonally positioned allowing for fine adjustment of detector positioning and to scan the detector on the image plane to acquire projection images with a matrix area of 2048x2048 pixels by adjoining complementary portions of a projection. The animal holder is located at 25 cm and the detector is at 70 cm from the micro focus source for a system with a magnification of 2.8.
Results:MicroPCCT reconstructed tomographic data with a resolution of 50 μm is achievable using 512 projections. The images show the characteristic features of phase contrast images such as an increase in the contrast at bone/tissue and tissue interfaces when compared with standard microCT images. The images are reconstructed using an adaptation of the Feldkamp's cone beam CT algorithm to enhance the boundaries definition of the phase contrast tomographic images.
Conclusions:We evaluated the performance of a microPCCT system by imaging murine models for radiobiological experiments. The system demonstrates the feasibility of acquiring phase contrast images with bench top equipment and a maximum achievable resolution of 50 μm.