

AbstractID: 7744 Title: Development of a Variable-Aperture Collimator for Small Animal Radiation Therapy

**Purpose:**

An automatic variable-aperture collimator has been developed to use a diagnostic animal CT for small animal radiation therapy. This system, together with a 3D translation bed stage, will enable the application of advanced clinical radiotherapy techniques to animal models of disease.

**Method and Materials:**

The collimator is mounted on the gantry of a GE RS120 microCT scanner (GE Medical Systems, Milwaukee, WI), between the x-ray source and the bore. It consists of two stages offset by 30°, each with 6 trapezoidal brass blocks moving along a hexagonal frame, pushed by 3 slots on a rotational driving plate to create hexagonal openings. The openings of the two stages always form a constant ratio, to fit with the microCT x-ray beam divergence. The collimator axis to x-ray beam alignment has been assessed by imaging the aperture. An algorithm has been developed to measure the misalignment and to guide the collimator position adjustment. The torques required to drive the two stages were measured by a torque meter during the design.

**Results:**

Geometric analyses and direct measurement demonstrated that the projected aperture on the iso-center plane is 3.5 mm/degree of driving plate rotation. The collimator can provide 98% of attenuation for 120 keV photons, sufficient for therapeutic narrow beam generations. The collimator-beam alignment can be adjusted to better than 0.2 mm, compared with the 0.3-mm source spot size. With the designed ratio of the openings, a regular dodecagonal aperture is formed from the source view. The measured torque to open and close a stage ranges from 1 to 5 N-m. A 30-N-m driving motor has been selected accordingly.

**Conclusion:**

A variable-aperture collimator has been constructed. Using a commercial animal CT one can deliver narrow beam x-ray to experimental animals, so that advanced clinical radiation therapy techniques can be applied in pre-clinical research.