

Purpose: A customized gating system was developed for a large bore CT scanner to produce gated images for use with an active breathing control (ABC) system. Operator triggering following a breath hold is replaced by an electronic gating signal from a bellows. A breathing phantom was constructed and imaged to insure accurate gating.

Methods and Materials: A bellows strap wraps around the patient to monitor breathing during CT scans. A universal serial port (USB) cable provides power to the bellows sensor via the circuit box. Bellows signals route to the computer from the circuit box via another USB cable. Operators can set a threshold point in the breathing cycle that corresponds to an ABC breath-hold to trigger the CT scanner. Software generated signals gate the CT through the circuit box. Unique to this system is an option to scan continuously while the patient is holding a breath, in contrast to commercial gated-CT systems which take one image per breathing cycle. A breathing phantom was created using a computer programmed actuator, step-motor, and off-set ball. A sine wave modeled on human breathing was fed to the actuator. The moving range was 2.10 cm anterior-posterior and 1.05 cm in lateral direction. The diameter and motion period was 6.4 cm and 5.54 sec. Phantom images taken were: stationary non-gated, moving gated, and three un-gated while moving. All image sets were analyzed with the Pinnacle planning system. Volumes generated from contours were used as a metric to determine imaging accuracy.

Results: Target volumes of stationary and gated imaging were 146.8 and 145.5cm³, respectively (1% agreement). However, the discrepancies between stationary and all three un-gated scans ranged from 4.84 to 5.45% with significant shape distortion.

Conclusions: We successfully created a custom gating system for a large-bore CT simulator.