Purpose: While several ionization chambers and solid state detectors are commercially available for CT, their energy dependency has yet to be determined. This work evaluates the energy response of a 0.6-cc ionization chamber and solid state dosimeter against an ionization chamber specifically calibrated at several diagnostic energy levels (reference chamber) as a function of HVL for in-air and in-CTDI phantom measurements.

Methods: For two CT scanner models of known difference in beam spectra, HVL's for all available kVp's were obtained with measurements (in-air) and from Monte Carlo simulations (in head and body CTDI phantom). The reference ionization chamber was calibrated by the UWADCL using reference beams with HVL's in the CT range. Calibration factors for the reference chamber at each measured/simulated HVL were calculated based on polynomial fit of the UWADCL-beam factors. For each scanner, exposure conditions were established at each kVp by varying mAs to obtain similar results in the reference chamber. Both test dosimeters were then scanned at these conditions and the exposure (or dose) relative to the reference chamber was obtained; no specific energy corrections were applied for either test device. The same procedure was performed with the head and body CTDI phantoms for both CT scanners.

Results: HVL's from the scanners ranged from 3.49 to 9.7mm Al in-air and from 3.1 to 8.8mm Al in-phantom. Doses measured by the test chamber matched those of the reference chamber across scanners and kVp's to within 3.5% in-air, 4.9% in head phantom and 11.8% in body phantom. Differences in the solid state device were larger: as high as 16%, 21%, and 37% for in-air, head, and body phantom, respectively.

Conclusions: While ionization chambers have some energy dependence in the diagnostic range, solid state detectors exhibit a more pronounced energy dependence and correction factors should be applied based on HVL.