Purpose: Beam quality measurement on commercial whole body CT scanners generally requires the presence of the service engineer to stop the gantry's rotation using a service mode; consequently, the half-value layer (HVL) is not regularly assessed. An apparatus was constructed and allows for HVL measurements to be performed using a standard axial scan with a prototype real-time (RT) isotropic dose probe.

Method: The HVL apparatus consisted of eight plates of high purity aluminum (type 1100) equally spaced around the probe's detective volume. The thickness of the plates ranged from 0.81 mm to 13.51 mm; the x-ray beam was attenuated by varying amounts as the gantry rotated. From the acquired signal train, the relative signal of the attenuated beam to the unattenuated beam was used to estimate the HVL. The HVL measurements made with the prototype apparatus were validated against conventional methods on a prototype dedicated breast CT (bCT) scanner over a range of x-ray tube voltages. The energy dependence of the prototype probe's output was compared to that of an ion chamber. The HVL measurements were then demonstrated on a clinical whole body CT scanner at four discrete x-ray tube potentials.

Results: The energy dependence of the RT probe was found to be non-linear as compared to the conventional ion chamber, and a calibration factor for the RT solid-state probe was produced. After converting the probe's signal into units of air kerma, the HVL measurements using the proposed techniques were found to be equivalent to those found using traditional techniques.

Conclusions: A proposed new method and apparatus for measurement of the HVL in whole body CT scanners provides for a fast, noninvasive measurement of x-ray beam quality within a single scan. Using this approach, it is anticipated that HVL measurements across kV settings can be routine in CT scanner evaluation.