AbstractID: 6851 Title: X-ray scattering and fluorescence spectroscopy as a possible tool for kVp monitoring

Small changes in the peak voltage of a diagnostic x-ray tube can cause significant modifications in the absorbed dose or degrade the contrast of an x-ray image. It has been suggested that kVp should be monitored routinely however a standardized noninvasive technique for kVp monitoring has yet to be developed. A number of x-ray beam-related quantities depend upon the endpoint energy including, intensity, penetrability and dosage. However, none of these parameters can be used to determine kVp for x-ray tubes in general.

If a material is irradiated by an x-ray beam, spectra for Compton scattered photons as well as x-ray fluorescence lines that are a characteristic of the target material can be simultaneously collected. The ratio of the integral number of Compton scattered photons and the number of fluorescent x-ray photons is a function of the maximal beam energy and same time independent of the tube current, measurement geometry, and other quantities that are related to the experimental setup.

CdTe detectors having sufficient energy resolution to distinguish individual x-ray fluorescence lines and high efficiency for energies in the 10-keV region were used in our measurements. Several materials covering a wide range of atomic numbers from Copper (Z=12) to lead (Z=82) were used as the medium for fluorescence and for scattering. A variety of scattering angles and detection geometries were tested.

Our measurements have demonstrated that the ratio of the integral number of Compton scattered photons to that of fluorescent photons using a fixed geometry is a sensitive index of kVp (peak tube voltage).