AbstractID: 11153 Title: Reconstruction of Mammography X-Ray Spectrum using Rayleigh and Compton Scattering Corrections

Purpose: An analysis of the x-ray spectrum is important for quality assurance (QA) and quality control (QC) of a radiographic system. In the case of mammography, the direct measurement of the primary x-ray spectra under clinical conditions is very difficult and time-consuming. The method of obtaining the primary x-ray spectrum by the Compton scattering correction has been established for relatively high x-ray tube voltages. However, the influence of Rayleigh scattering can not be neglected for mammography. We have developed a new method of reconstructing the primary x-ray spectrum from the scattered x-ray spectrum taking into account both Rayleigh and Compton scattering.

Method and Materials: The primary x-ray beam from a 28 kV mammography x-ray unit was incident on a PMMA (polymethyl methacrylate) sphere scatterer with a diameter of 6 mm. The 90-degree scattered x-ray spectrum was measured by using a CdTe semiconductor detector. The measured x-ray spectrum was separated into three energy regions, and the characteristic x-ray peaks and bremsstrahlung x-rays were fitted by Gaussian and quadratic functions. The energy shift corrections of the Compton and Rayleigh components were made at each photon energy channel by splitting the number of photons at each channel into the two scattering components according to the corresponding cross sections. The Monte Carlo simulation of the 90-degree scattered x-ray spectra were also performed using the EGS5 code. **Results:** The reconstructed spectrum agreed fairly well with a directly measured primary x-ray spectrum. In the Monte Carlo simulation, the scattered x-ray spectrum calculated for the incidence of the reconstructed x-ray spectrum showed a very good agreement to the measured scattered x-ray spectrum. **Conclusions:** The Rayleigh and Compton scattering correction method could be suitable for measuring the mammography x-ray spectra under clinical conditions and useful for QA and QC of the mammography x-ray units.