Purpose: To devise a scatter technique for extracting differential linear scattering coefficients of breast biopsies.

Methods: An energy dispersive x-ray system is used to measure the scattered number of photons $N_s(E)$ as a function of energy ($E$) from a 5 mm diameter 3 mm thick polycarbonate (lexan) biopsy at 6 degree, 12 degree, and 18 degree. A 50 kV 2.3 mA polychromatic pencil beam irradiates an area of 2.62 mm diameter on the sample for 3 minutes ($X = 0.18$ C/kg). A 25 mm$^2$ by 1 mm thick CdTe detector is positioned 43 cm from the target with a 4.2 mm diameter aperture defining its active volume. $N_s(E)$ spectra coupled with a semianalytic model are used to determine the differential linear scatter coefficients $M_U(x)$ of biopsies, where $x = E/(hc) \sin(\theta/2)$ is the momentum transfer argument. The $N_s(E)$ spectrum for a biopsy of water was measured and was used with the model in reverse fashion to estimate the incident number of photons $N_0$. Water is chosen because diffraction data for water is considered the gold standard.

Results: The $M_U$ values were calculated using a bin size $x = 0.06$ nm$^{-1}$ and $E$ ranging from 7 to 40 keV. The values of $M_U$s for lexan obtained at 6 degree using an $N_0$ estimated from a 6 degree water scatter measurement were in good agreement with literature provided that a background subtraction correction is applied. At $x = 0.96$ nm$^{-1}$ the peak height is $M_U = 30.7$ m$^{-1}$ sr$^{-1}$, a 2% overshoot. The $M_U$s for lexan obtained from the 12 degree scatter measurement but with $N_0$ estimated using the 18 degree scatter water measurement also resulted in good agreement with a 9% overshoot at the peak.

Conclusions: This work demonstrates a scatter technique with great potential for measuring the scatter signals of breast biopsies.