Abstract ID: 16897 Title: An X-ray Scatter Technique for Extracting Differential Linear Scattering Coefficients

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 Ns(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. Ns(E) spectra coupled with a semianalytic model are used to determine the differential linear scatter coefficients MUs(x) of biopsies, where x=E/(hc) sin(theta/2) is the momentum transfer argument. The Ns(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 No. Water is chosen because diffraction data for water is considered the gold standard.

Results: The MUs values were calculated using a bin size x = 0.06 nm^{-1} and E ranging from 7 to 40 keV. The values of MUs for lexan obtained at 6 degree using an No 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 MUs=30.7 m^{-1} sr^{-1}, a 2% overshoot. The MUs for lexan obtained from the 12 degree scatter measurement but with No 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.