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## Wide angle x-ray scatter models in breast diagnostics

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In our group we are devising wide angle x-ray scatter (WAXS) models for breast diagnostic applications. A major focus is to use the models in conjunction with energy dispersive x-ray scatter measurements on breast biopsies. A custom built WAXS system has been assembled and it provides quantitative differential linear scatter coefficients (MUs) to be obtained for samples. Comparison between fibrous and cancerous breast samples showed differences but results were not consistent. The fat content in the biopsies could have affected the results. A method to correct for the presence of fat has been formulated and tested with breast phantom materials. A digital x-ray imaging method provides estimates of the fractional volume of fat  $v_f$  in the biopsies. The protocol for analysis is first to measure the MUs of the composite sample in the WAXS system, then estimate  $v_f$  of the sample via an x-ray imaging analysis in another system. Once  $v_f$  is known, a WAXS fat subtraction model using  $v_f$  is applied to estimate the MUs of fatless tissue. Consider a chicken composite consisting of fibrous and tissue components. The  $v_f$  within an ROI of the sample was estimated to be  $0.32 \pm 0.05$ . The subtraction of this component from the WAXS composite signal provided a good estimate of the MUs of chicken fibrous. The results were encouraging and analysis of breast biopsies is to re-commence. The WAXS models are also being investigated for their potential use in CBCT breast imaging. The models can be used to correct for scatter. The scatter projection obtained via the WAXS model was subtracted from a GEANT4 projection to yield an estimation of the energy incident signal from primary photons. For a 14 cm diameter cylindrical 50:50 fat/fibrous phantom the estimation was  $1.017 \pm 0.012$  relative to the GEANT4 output.

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