Imaging Breast Microcalcifications Using Dark-Field Signal in Propagation-Based Phase-Contrast Tomography

A. Aminzadeh, B. Arhatari, A. Maksimenko, C. Hall, D. Hausermann, A. Peele, J. Fox, B. Kumar, Z. Prodanovic, M. Dimmock, D. Lockie, K. M. Pavlov, D. Thompson, S. C. Mayo, D. M. Paganin, S. T. Taba, S. Lewis, P. C. Brennan, H. M. Quiney, T. E. Gureyev.

Breast microcalcifications are an important primary radiological indicator of breast cancer. However, microcalcification classification and diagnosis can be still challenging for radiologists due to limitations of the standard 2D mammography technique, including spatial and contrast resolution. In this study, we propose an approach to improve the detection of microcalcifications in propagation-based phase-contrast X-ray tomography (PB-CT) of breast tissues. Five fresh mastectomies containing microcalcifications were scanned at the Imaging and Medical beamline of the Australian Synchrotron at different X-ray energies and radiation doses. Both bright-field and dark-field images were extracted from the same data sets using different image processing methods [1]. A quantitative analysis was performed in terms of visibility and contrast-to-noise ratio of microcalcifications. The results show that the visibility of the microcalcifications in the dark-field images is more than two times higher compared to the bright-field images. Dark-field images have also provided more accurate information about the size and shape of the microcalcifications [2]. Therefore, dark-field PB-CT images are likely to help radiologists evaluate the probability of breast cancer more effectively. This work has been conducted in the course of developing a medical imaging facility at the Australian Synchrotron for advanced breast cancer imaging.

References:

[1] T. E. Gureyev, et al., Phys. Med. Biol. 65, 215029, 2020.

[2] A. Aminzadeh et al., submitted.