AbstractID: 11927 Title: Photon Counting Detectors for Mammography

Mammography is currently one of the most common x-ray imaging examinations. More than 100 million women worldwide are screened every year and early detection of breast cancer through mammography has proven to be a key to significantly reduced mortality. The requirement on spatial resolution as well as contrast resolution is very high in order to detect and diagnose the cancer. Moreover, because of the large number of women going through this procedure and the fact that more than 99 % are healthy, it also becomes very important to minimize the radiation dose.

Photon counting may be one way to meet the demands and mammography is the first modality in x-ray imaging to implement photon counting detectors. FDA approval is still pending but they are currently in routine clinical use in more than 15 countries. The photon counting enables a discrimination of all electronic noise and a more optimum use of the information in each x-ray. The absence of electronic noise is particularly important in low dose applications, in for example tomosynthesis a number of exposures from different angles are required and since the dose in each projection is just a fraction of the total dose for a mammogram the sensitivity to electronic noise will increase.

Using the spectral information for each x-ray it is in principle possible to deduce the elemental composition of an object in the breast. This could for example be used to enhance microcalcifications relative to soft tissue and differentiate water from fat in cysts. Recently contrast mammography has attracted significant attention. In this application Iodine is used as a contrast media to visualize the vascular structure. As in breast MRI the cancer stand out because of the leaky vessels resulting from its angiogenesis. A photon counting detector gives a unique opportunity to image the Iodine through spectral imaging by adjusting one of the thresholds to its K-edge.

Challenges for photon counting in mammography are high rates of x-rays, both to generate the required flux at the source and to handle the rates at the detector without pile-up. Even more difficult to handle are the charge sharing between detector pixels which, if not corrected for, will compromise the energy information.

The current status of photon counting detectors in mammography will be described together with strategies to overcome the pit-falls. Also future possibilities with spectral imaging in mammography will be investigated and examples from ongoing clinical trials will be given.

Learning objectives:

1) Status of photon counting detectors in mammography
2) Pit-falls and opportunities with photon counting detectors for mammography
3) Future applications based on spectral detectors for mammography