Abstract:
Positron emission tomography (PET) is a non-invasive biomedical imaging technology that shows promise for more accurate identification of cancer than other imaging modalities due to its potential to sense and visualize increased molecular changes in malignant compared to healthy tissue well before structural or physiological changes occur. PET uses a radioactive molecular contrast agent that preferentially accumulates in cancer cells. Each radioactive decay yields two oppositely directed high energy (511 kilo-electron-Volts) photons. The PET system collects millions of these two-photon events, measures the spatial, spectral, and temporal of each photon detected, and processes this information to reconstruct three-dimensional images of the biodistribution of the contrast agent. However, nearly all available clinical PET systems are whole body imaging systems and not effective for detecting early signs of cancer due to factors such as large-diameter, low photon sensitivity geometry, inadequate spatial and contrast resolutions for detecting small lesions, relatively high cost, and long scan times. An example of this inadequacy is in breast cancer management where PET currently plays little or no role at all. To address these issues for breast cancer, we are developing an advanced, high performance, breast-dedicated PET system. This camera will work in conjunction with new, more specific breast cancer molecular tracers also under development. If successful, these advances will enable PET to play a more significant role in breast cancer management. This talk will describe the breast-dedicated camera design features, including new PET system technologies we are developing to enhance the visualization and quantification of early cancer, as well as present predicted system performance from computer-simulated breast tumor imaging studies.

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