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PET CAMERA DESIGNS FOR IMAGING BREAST CANCER AND AXILLARY NODEINVOLVEMENT*. W.W. Moses, T.F. Budinger, R.H. Huesman, and S.E. Derenzo. Center for Functional Imaging, Lawrence Berkeley Laboratory, University of California, Berkeley, CA.

We propose a design for a PET camera dedicated to imaging breast tumors with high selectivity and specificity, but low cost and injected FDG dose. This extends a previous design[1] by providing higher sensitivity and more accurate images by 1) completing the detector "ring" around the breast, which increases the sensitivity by a factor of two and improves angular sampling for the tomographic reconstruction, and 2) constructing the detector ring with modules having better depth of interaction measurement resolution, which reduces the extreme parallax errors present when the object to be imaged is adjacent to the detectors.

A similar design can image the axillary nodes and determine the extent of nodal involvement. As with the breast camera design above, the critical requirements are that a septaless, complete detector ring encircle the shoulder region and that the detector modules have good depth of interaction measurement resolution. This geometry has nearly 100-fold greater sensitivity than a conventional 2-D PET camera — a factor of 4–5 due to increased solid angle and a factor of 20 from lower attenuation.

The critical element is the detector module, which is an 8x8 array of 3 mm square by 25 mm deep LSO (Lu_2SiO_5:Ce) scintillator crystals coupled on one end to a common photomultiplier tube (PMT) and on the opposite end to a silicon photodiode (PD) array. The PMT provides a timing pulse and energy discrimination for the 64 crystals in the module and the PDs identify the crystal of interaction. Each LSO crystal is coated with a "lossy" reflector, so the ratio of light detected in the PD and PMT can be used to measure the position of interaction with 5 mm fwhm accuracy. Thirty such modules can be arranged to form either a breast camera or an axillary node camera, and existing tomographic data acquisition hardware and reconstruction algorithms can easily be adapted to accumulate and reconstruct data from this configuration.

[1]Thompson CJ, Murthy K, Weinberg IN, et al. *Med. Phys.* **21:** p. 529–538, 1994.

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