

## SiliSPECT: A Double-Sided Strip Silicon Detector-Based SPECT System

This work describes preliminary test studies with a dual-headed SPECT system that utilizes a new generation of silicon double-sided strip detectors (DSSDs) (Figure 1) with a 1-mm bulk thickness and larger active area ( $60 \times 60 \text{ mm}^2$ ) as compared to standard gamma-ray silicon detectors. Furthermore, major improvements in the ASIC design make this detector very suitable for low-energy imaging of small animals. The  $1024 \times 1024$  virtual pixel arrangement makes these the first true megapixel gamma-ray detectors.

The data-acquisition processes the list-mode data from independently triggered p- and n-strips from each side of the detector to obtain the interaction coordinates. We and our collaborators at Vanderbilt University have developed algorithms to detect the coincident triggers based on their time stamp and ADC values in both live and off-line coincidence readout. Two 1-mm-thick silicon detectors were stacked and placed in each camera head as part of initial detector testing. This not only increases the detection efficiency, but also allows the implementation of synthetic-collimator imaging. The utility of this approach was validated by performing Monte Carlo simulations using MCNP5. The stacked detector setup was tested experimentally by flood-source acquisitions with slit/edges placed on the detector and with attenuation objects placed above the detector (Figure 3).

We are currently developing a second-generation detector enclosure which will be more adaptable to future imaging configurations than the current Vanderbilt box (Figure 2).

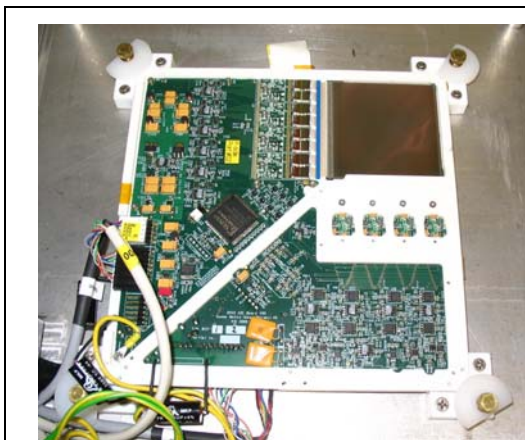


Figure 1. Dual-sided silicon strip detector



Figure 2. DSSD test housing and interfacing equipment

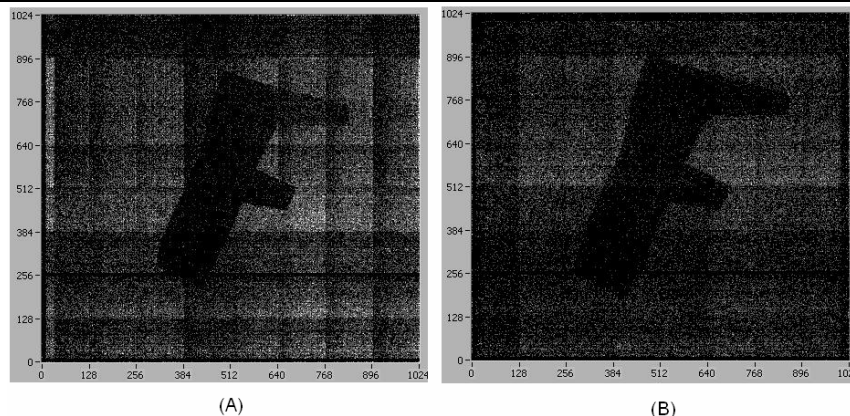


Figure 3. Stacked-detector image of attenuation object. (A) Top detector. (B) Bottom detector.

S. Shokouhi, H.L. Durko, M.A. Fritz, L.R. Furenlid, and T.E. Peterson, "Thick Silicon Strip Detectors for Small-Animal SPECT Imaging", Proceedings of the IEEE Nuclear Science Symposium and Medical Imaging Conference, San Diego, February 17-22, 2006.