

## AbstractID: 3576 Title: Performance Evaluation and Comparison of Two Cadmium Zinc Telluride Gamma Cameras

**Purpose:** We evaluate and compare the imaging performance of two prototype Cadmium Zinc Telluride (CZT) gamma cameras. The long-term use of these systems is gamma-ray imaging of small animals and laboratory research.

**Method and Materials:** The two systems, made by Mosaic Imaging Technology, Inc., using CZT modules and components from IMARAD, Ltd., consist of a 25-module carrier board, power supplies, and pulse processing and data acquisition boards. In testing we used 2 modules in the original prototype and 3 modules in the newer system. Each CZT module is a 38x38x5 mm monolithic crystal divided into 16x16 pixels, with two logic/pulse-shaping ASICs. The original prototype uses older ASIC designs. We developed detector initialization and control software in LabVIEW 7.0. In operation, the detector processes each gamma ray interaction to produce energy and pixel information, which the LabVIEW program converts into energy spectra and images. The imaging performance of the two systems is evaluated using the NEMA NU 1 (2001) guidelines. Performance tests include energy resolution, spatial resolution, flood field uniformity, linearity and count rate performance.

**Results:** In operation, the original prototype's modules generally show better performance than the newer modules, which require more tuning to achieve satisfactory imaging performance. Intrinsic spatial resolution is limited by the 2.4-mm pixel pitch of the CZT modules. The original prototype's overall energy resolution is 7.2% FWHM for Tc-99m and somewhat worse for the new system. Energy resolution for individual pixels is even better, but photopeak locations vary. Linearity, uniformity and count-rate performance are comparable for the two systems, but the new modules generally have more dead pixels than the older modules.

**Conclusions:** Individual CZT pixels have superior energy resolution compared to NaI(Tl), but intrinsic spatial resolution is slightly worse. The large pixel size impacts the utility of CZT gamma cameras for high-resolution applications.