This work aims to combine gamma-ray coincidence and pinhole imaging, where the former relies on 511 keV annihilation gamma pairs and the latter is applicable to low energy gammas (10 keV – 200 keV). The goal being to provide users with a single system that provides both imaging modalities simultaneously. To conduct these studies, the OrionUM detector is used which is a 3 x 3 array of CdZnTe crystals, each with pixelated anodes and a planar cathode; each crystal in the array is 20 mm x 20 mm x 15 mm with a 5 mm gap between the crystals. A multi-pinhole coded aperture mask is used where each crystal has its own pinhole (9 pinholes total) and the data gathered from each crystal is stitched together to form a single image. This will allow for single-photon emission computed tomography (SPECT) imaging and positron emission tomography (PET) imaging to be done simultaneously. CdZnTe detectors have a high energy resolution which allows for gamma-ray discrimination and a high position resolution of 300 μm in all three dimensions, making them more advantageous than current instruments used for PET and SPECT high-resolution imaging. However, non-uniformity of detection sensitivity underneath each pixel anode, non-linear electric field, and the gridded pattern of the anode electrodes introduce distortion in reconstructed gamma-ray image. To demonstrate the PET-SPECT combined imaging ability and to study the characteristics of this imaging modality on 3-D CZT detectors, a rat was injected with Technetium 99m-methyl diphosphonate for the SPECT imaging of 140 keV gammas and fluorodeoxyglucose (FDG) for the PET imaging of coincidence 511 keV gammas. The experiment and gamma-ray imaging results are reported. Some techniques and their improvements on reducing image distortion are discussed which will help on high resolution gamma-ray imaging systems using 3-D CZT detectors.