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Panel TOF-PET imager

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Positron emission tomography (PET) is one of the most important diagnostic tools in medicine, providing three-dimensional imaging of functional processes in the body. The method is based on detecting two gamma rays originating from the point of annihilation of the positron emitted being by radio-labelled agent, and used to follow the human's physiological processes. In Time-Of-Flight PET gamma rays' arrival time is measured in addition to their position. The coincidence timing resolution (CTR) of state-of-the art scanners is between 200 ps and 500 ps FWHM, which can already significantly improve the contrast in imaging large objects. To increase the sensitivity of the next-generation PET scanners timing accuracy should be substantially increased. By using latest advances multichannel system with improved CTR is becoming technologically possible. Generally 3D images from limited angle PET scanners are distorted and have artefacts. Fortunately, with improving timing resolution of PET gamma detectors, artefact free images can be obtained even by a very simplified detector. In the contribution we will show the simulation studies of the simple panel detector using gamma detectors with 50 ps coincidence timing resolution. With this new concept, the price of PET scanners for imaging single or multiple organs can be drastically decreased. We evaluated different panel detector arrangements by imaging different phantoms. We compared the reconstructed images with the image obtained with the Siemens Biograph Vision, state-of-the-art clinical PET scanner. We found comparable image quality parameters of both systems when the CTR approaches 50ps FWHM and also that good CTR can partially compensate for smaller gamma detection efficiency.

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