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A method to use tissue-scattered coincidence photons in positron emission tomography

Current techniques for reconstructing images in positron emission tomography (PET) cannot correctly use events in which at least one photon of a pair has scattered in tissue (also known as scatter coincidence events). Since typically in clinical PET scans half or more of the collected coincidence events have one or more photons that scatter, a large fraction of incoming events are not used in image reconstruction.

Researchers at Stanford University have developed a PET system comprising 3-D PET detectors and an image reconstruction algorithm that can use tissue scattered coincidences to produce improved 3-D tomographic images. By capturing this additional information (that is normally discarded), the technology substantially improves the precision of the resulting images. This method could also be available to Compton cameras.

Stage of Research
The scatter projector function has been validated using Monte Carlo simulated data.

Ongoing Research
The inventors continue to refine and validate this new method.

Applications

- High Resolution PET Imaging: for a variety of clinical indications, including cancer staging and monitoring
- Other non-medical applications: scintillation detection, gamma ray spectroscopy, gamma ray astronomy where external photon scatter poses a challenge

Advantages

- Accurate images: increased statistics of the data set could improve sensitivity, image quality, and quantification
- New approach increases the number of counts in a PET acquisition
- This approach could also be available to Compton cameras

Publications

- G Chinn, AMK Foudray, CS Levin, "Accurately Positioning and Incorporating Tissue-Scattered Photons into PET Image Reconstruction," *Nuclear Science Symposium Conference Record*, 2006. IEEE, 2006.
- G Chinn, CS Levin, "PET image reconstruction with a Bayesian projector for multi-electronic collimation schemes," *Nuclear Science Symposium Conference Record*, 2007. IEEE, 2007.

Patents

- Published Application: 20090078876
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