Simulation Studies of Gamma Ray Attenuation inside a Patient

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Research done at the Boston University
Positron Emission Tomography(PET) Physics Lab

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Positron Emission Tomography is a medical imaging technique that measures metabolic activity of body cells. PET detectors produce tomographic images which provide information about the body's chemistry and function. However, PET detectors face a major problem with a process called attenuation, in which photons become absorbed or scattered. In order to obtain precise quantitative tomographic images, it is necessary to incorporate the attenuation effect in a 3-D reconstruction algorithm. An effective approach to attacking this problem is to utilize computer simulation of attenuation inside the patient and the detector. In this experiment, the effects of gamma ray attenuation inside a patient were studied utilizing FORTRAN simulations of the Boston University PET detector. The program consisted of 6 main parts: 1. Generating the spinning source; 2.) Generating the 3D direction for where the gamma ray goes; 3. Simulating the attenuation around the point source; 4. Simulating the attenuation inside the detectors; 5. Determining if the gamma rays reached both modular detectors; 6. Backprojecting the data to produce the tomographic image. The program was tested with a variety of variables, and is currently being incorporated into a 3-D image reconstruction algorithm which will be used for detecting cancer in humans.