Institut für Medizintechnik

Master Thesis

Joint image reconstruction for PET & Compton Camera

Motivation: There is an increased interest in imaging non-pure β^+ emitters for diagnosis and theranostics. In addition to positron emission, those tracers exhibit additional gamma emissions. Within this project, the potential combination of a Compton camera (CC) and a PET detector is studied in simulation. While Compton cameras are well-established detection devices in far-field imaging, e.g., astrophysics, their application to medical imaging is still under investigation, e.g. for range verification of hadron therapy. Therefore, their application to near-field imaging requires detailed simulation studies to determine the optimal configuration. This unique hybrid detection concept will require also a novel image reconstruction software, aimed to jointly reconstruct tomographic images from PET and CC within a single algorithm.

Methods: The aim of the proposed master thesis is to develop such an algorithm for joint PET-CC reconstruction. Instead of independent reconstruction and co-registration of the resulting images, the aim is to use PET and CC data simultaneously to reconstruct a combined image. One modality could be used to improve the estimate of the other modality in an iterative algorithm, thus leading to a mutual improvement of the image estimators. Furthermore, adaption of the system model should help to enhance common structures of both datasets.

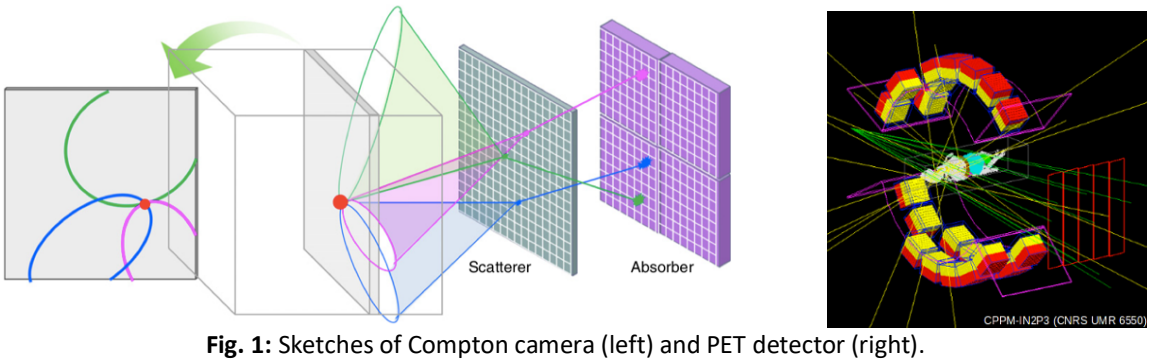

Fig. 1: Sketches of Compton camera (left) and PET detector (right).

Required Skills: C/C++, MATLAB, knowledge in nuclear imaging & image reconstruction

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