Bachelor Thesis:

Optimization of a reconstruction process for the determination of the resolution of a Compton camera absorber in the field of medical imaging

Our group at the Chair of Medical Physics in Garching (LS Parodi) is developing a Compton camera detection system in the framework of medical imaging and we are looking for a highly motivated

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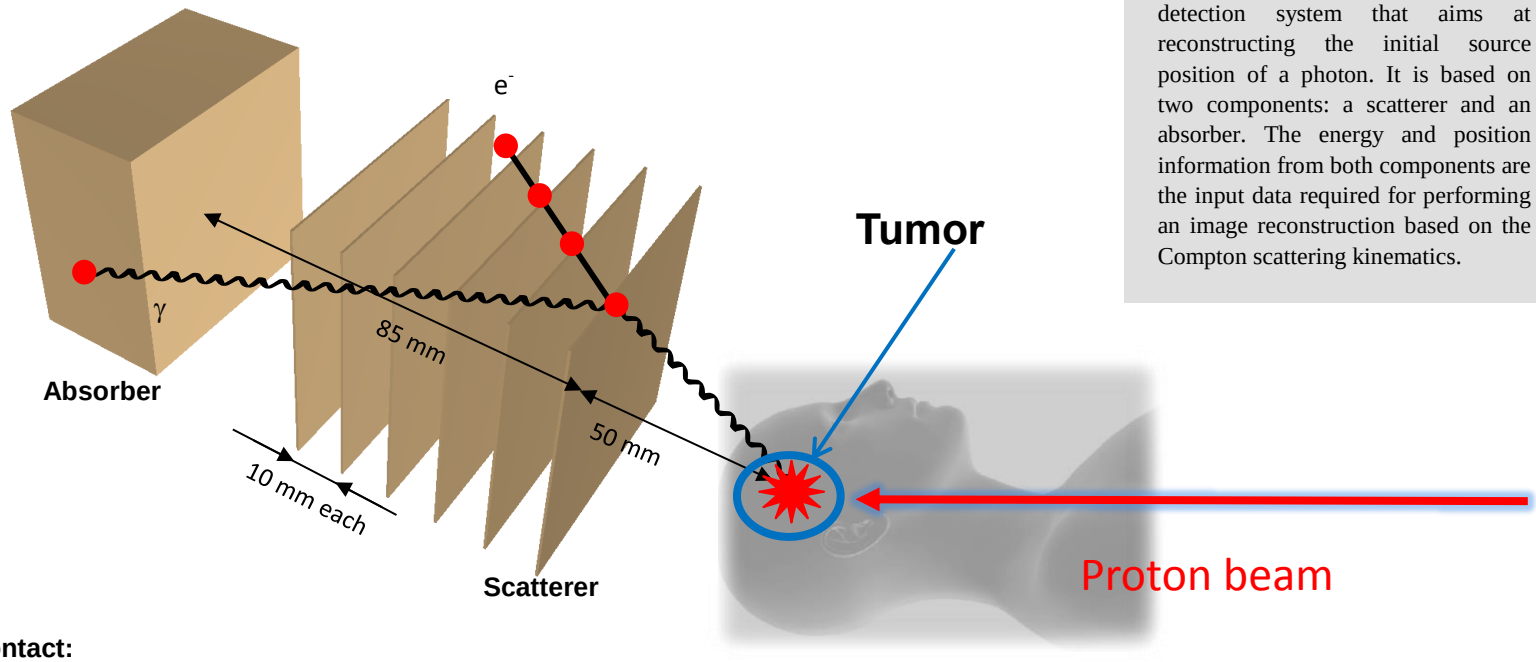
to support our team. The absorber component of our system consists of a monolithic scintillator detecting prompt γ-rays. The determination of the spatial information is not trivial: the estimation of the γ-ray interaction position in the absorber scintillator has to be performed by applying a specific algorithm ("k-Nearest-Neighbours"), that compares a prompt γ-ray from a source with an unknown position with a reference library of 2D light amplitude distributions from well-known irradiation positions (acquired with a collimated γ-source).
During the development of our system, the procedure of deriving the spatial information in a multi-step computational effort generated several individual scripts (in Matlab and C++) to prepare the data for the reconstruction process and perform correction steps.
The aim of this Bachelor Thesis is to consolidate our computational framework by merging the so-far individual steps into a single tool that allows for easier (and less prone to user mistakes) handling and optimized execution speed (e.g. by porting the Matlab script to a C++ framework (compatible with the ROOT toolkit)).

optimize the whole process to save computer time and reduce the complexity of the process by matching all the scripts for a better and faster handling.

Your results will play a central role for future experiments in our group. The project can be started from April 2017 onwards.

Previous knowledge in C++ and MatLab is mandatory. A prerequisite is also motivation and enjoyment of interdisciplinary work.

Compton camera system



Proton therapy and proton range verification

Proton therapy is nowadays considered an advantageous option in cancer treatment, because it gives the possibility to release the maximum of the dose delivered to the target in the cancer volume, destroying tumoral cells and limiting the dose to healthy tissues.

However, treatments delivered by proton therapy are affected by uncertainties on the range of the beam within the patient. To better control this range and deliver safer treatments, real-time range control should be used by imaging prompt γ-rays emitted from nuclear interactions along the proton tracks in the patient.

The overall aim of our project is to develop a Compton camera for real-time proton range verification. This Bachelor Thesis will contribute by consolidating our computational framework for position determination in monolithic scintillators.

Compton camera

A Compton camera is a photon detection system that aims at reconstructing the initial source position of a photon. It is based on two components: a scatterer and an absorber. The energy and position information from both components are the input data required for performing an image reconstruction based on the Compton scattering kinematics.

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