

PhD in Tomographic image reconstruction

ETH Zurich, Institute for Particle Physics, PET group

For the SAFIR project we are looking for a highly motivated PhD student implementing and testing 4D tomographic image reconstruction algorithms. The position will be open until filled.

The SAFIR (Small Animal Fast PET insert for MRI) project is developing a PET detector insert for a commercial Bruker 70/30 pre-clinical MR system for dynamic and truly simultaneous PET/MR imaging. The goal is reaching a temporal resolution of ~ 5 s or better, for tracking variations in tracer concentration.

The successful candidate will:

- use our existing (GEANT4 based) simulation software to simulate different PET system configurations
- use the existing (STIR) based reconstruction software to analyse the simulated data with respect to NEMA standard and perform iterative image reconstruction
- study the performance of the system as a function of acquisition time and activity using time-frame based image reconstruction
- implement several 4D image reconstruction algorithms in the framework of the STIR library, in particular:
 - o An iterative temporal smoothing algorithm, using a non-linear spatio-temporal Kernel-based filter combined with expectation maximization
 - o An iterative algorithm based on smooth temporal basis functions such as cubic B-splines
 - o And possibly a wavelet-based reconstruction using B-spline wavelets in the spatial domain and E-spline wavelets in the temporal domain
- Validate the performance of the implemented algorithms with respect to the GEANT4 simulation data
- Participate in measurement campaigns using first the single ring detector and later the complete PET insert
- Apply the developed algorithms to the measured data and optimize their performance

The candidate has:

- successfully completed a Master study in Physics, Medical Physics or Computational Sciences
- an excellent mathematical background
- excellent programming skills, in particular in C++
- a very good knowledge of English

Experience with Monte Carlo simulations (in particular GEANT4), tomographic image reconstruction (in particular using STIR), and PET detector technology would be an advantage.

A good knowledge of German and/or French, as well as of the Python programming language, would be beneficial.

Interested candidates should send their CV and the names of two persons, who could provide a reference, to Werner.Lustermann@cern.ch.