**Diploma Work in Nuclear Physics at Physics Department and at ESS**

Two diploma work openings for simulations and laboratory characterization of the CALIFA detector - the calorimeter for the R3B experiment at FAIR, one diploma work opening for pulse shape analysis in double sided silicon strip detectors based on digital sampling techniques and one diploma work opening for simulation of medical isotope production at ESS are described below.

**The CALIFA detector at the R3B experiment at FAIR**

The calorimeter consists of ca 2000 scintillator crystals of ~20 cm length for detection of light charged particles (protons, tritons, alpha particles) and gamma-rays. It will be used in experiments with exotic relativistic ion beams at the new FAIR large scale facility under construction outside Frankfurt am Main. The Lund group has a leading role in the project.

For more information on FAIR, R3B and CALIFA see:

www.fair-center.eu

www.gsi.de/r3b

**GEANT4 simulations and surface for light collection in CALIFA elements**

The aim is to further develop a simulation program, written in C++ in the GEANT4 simulation environment, for light collection in long scintillator crystals of CsI(Tl) for the CALIFA calorimeter of the R3B experiment. The task also includes measurements on detector elements with the aim to improve models for surface reflection and to compare experimental results with predictions from the simulations.

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**Mean free path measurements in CsI(Tl) crystals for CALIFA**

The purpose of the diploma work is to design an automated system for mean free path measurements for optical photons in the CsI(Tl) crystals of the CALIFA detector. The linearity of light collection in a long CsI(Tl) crystal is sensitive to the mean free path of optical photons in the crystal material. The purpose of the work is to develop and test a set up to automate mean free path measurements that can be used for large numbers of crystals.

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**Pulse shape analysis in double sided silicon strip detectors for particle identification**

The purpose is to test different pulse shape algorithms for particle identification in single wafer Double Sided Silicon Strip Detectors (DSSSDs) using modern programmable sampling ADCs and a XY-table with high precision.

Varying charges and ranges of light charged particles in silicon give rise to electrical pulses of different shapes (e.g. rise and fall times) that depend on the properties of the electric field inside the detector material and thereby on the erosion time for the plasma that is created in the wake of a charged particle that traverses it. Due to doping inhomogeneity it has been difficult to utilize this effect for particle identification in the past. The aim of the project is to investigate the lateral size of the areas of different doping in a standard wafer, and to see if a set of parameters can be established to improve total resolution for the whole wafer and thereby make it possible to use the full detector surface of a standard detector for particle identification with high precision.

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**Diploma Work at ESS**

**Simulations for potential medical isotope production at ESS**

The high fluxes planned for ESS will provide an excellent opportunity to produce new isotopes for medical imaging and treatment. The purpose of the work is to investigate different design options for production of a set of new medical isotopes. The work will include simulation work and cross section calculations.

The work will be performed at the ESS and be supervised by ESS personnel with co-supervision at the Nuclear Physics Division at the Physics Department.

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