

# Tangerine Project: Transient Simulation Studies in a 65 nm CMOS Imaging Process

The implementation of new detector technologies is mandatory to continue the rapid evolution of High Energy Physics Experiments. The goal of the Tangerine project is to develop the next generation of monolithic silicon pixel detectors using a 65 nm CMOS imaging process, which offers a higher logic density and overall lower power consumption compared to previously used processes.

The performance aim of the project is to achieve excellent spatial and time resolutions, below 3  $\mu\text{m}$  and around 1 ns respectively. In order to understand the processes and parameters that are involved in the developments in the new 65 nm technology, a combination of Technology Computer-Aided Design (TCAD) and Monte Carlo (MC) simulations are utilized. The simulation results can later be compared to results from test beam experiments.

Transient simulations enable the study of the response of a sensor over time, i.e. the pulse produced after a charged particle passes through the sensor. The study of these signals is important to understand the time response of the simulated sensors, and enabling the use of time-overthreshold and time-of-arrival measurements in simulated data. One approach to this is by tuning physical parameters that intervene during the signal formation. Although TCAD simulations alone are very precise, the time to produce a pulse is several orders of magnitude larger compared to a combination of Monte Carlo and TCAD simulations.

This project will validate the pulse signals obtained with a Monte Carlo and TCAD combination by comparison with pure TCAD results, using different mobility and recombination models as tuning parameters.

The selected student will learn the basics of TCAD and Monte Carlo simulations and how to implement simulations to analyze the response of pixel sensors. The simulations will be performed using Synopsys TCAD and the Allpix Squared framework. Prior knowledge in Linux, Shell, C++ and ROOT will be helpful but is not required.

## Field

B3: Development of experimental particle physics equipment (hardware-oriented)

## DESY Place

Hamburg

## DESY Division

FH

## DESY Group

ATLAS (Tangerine)

## Special Qualifications:

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