

Hadron calorimeter prototype for future circular collider without power pulsing

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The research project includes the development of a high granular hadron calorimeter prototype based on the SiPM-on-tile technology. The main objective is to adapt the AHCAL (Analog Hadron CALorimeter) detector concept developed for a linear collider, for operation in circular colliders without power pulsing. This requires a re-design and optimization of the entire system, including the development of a readout chain adapted to circular colliders and new concepts for mechanical and thermal integration. The focus is on developing the mechanical and electronic concept of the calorimeter and constructing small demonstrators to be tested in the laboratory and with particle beams.

For this purpose, small cassettes consisting of several scintillators, SiPMs and readout chips are to be built. These will be used to build a small multi-layer stack and a thermal layer demonstrator. For the small multi-layer-stack 6 cassettes are arranged sequentially. This should provide information about the temperature behavior and temperature distribution within the device.

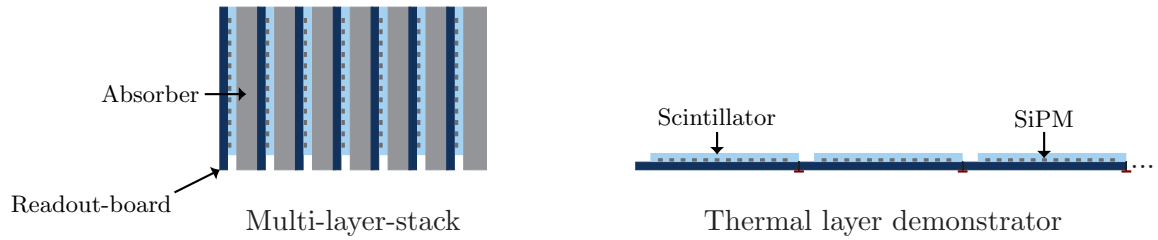


Abbildung 1: Sketch of the Multi-layer-stack (left) and the thermal layer demonstrator (right). The different parts of the cassettes are shown. The scintillator megatile (light blue) on the SiPMs (gray) soldered on the readout-board (dark-blue).

For the thermal layer and signal distribution demonstrator, an approximately 2 m long strip consisting of 6 cassettes is to be built to test the thermal and electronic properties of one layer. For example, communication is tested to determine whether signals can be sent and received synchronously over the entire length without loss of information or noise accumulation.

The prototype will offer a proof of concept for the operation of a particle flow calorimeter with the FCC-ee foreseen bunch structure.

The main contribution of the University of Hamburg and the aim of my doctoral research is the precise characterization of SiPM parameters and determination of the mass

production spread of this parameters. Furthermore, the work includes the calibration of the calorimeter response and propagation of the uncertainties from the SiPM characterization and parameter spread to the energy resolution. Finally, based on the knowledge gained, the aim is to develop a robust calibration strategy for FCC-ee.