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Read-out and data acquisition system development for FoCal-H

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In a letter of intent published by the ALICE collaboration in 2020, the proposal to integrate a new Forward Calorimeter (FoCal) as the forthcoming upgrade to ALICE was outlined. In this proposal, it was detailed that this new detector, FoCal, should be comprised of two sub-detectors. These would be an electromagnetic calorimeter (FoCal-E) and a hadronic calorimeter (FoCal-H), and the responsibility of designing, building, and testing these sub-detectors would be carried out by dierent research groups connected to ALICE.
The ALICE group at the University of Copenhagen has since the beginning spearheaded the development of the hadronic calorimeter, FoCal-H, whose first prototype was built and subsequently tested in September 2020. In these early tests, a readout system based upon the CAEN A1702 FEB was utilized, but after encountering numerous issues, this system was discarded. In the development of the second prototype of FoCal-H, an array of different readout solutions have been considered. Despite having issues with the A1702 FEBs from manufacturer CAEN, their newer model, the DT5202 FEB, was acquired and tested in conjunction with prototype II in numerous beam tests over the course of 2022 and 2023. Throughout these beam test it became clear that although not as bad as its predecessor, the CAEN DT5202 would not be a contender for the role of read out system for the final iteration of FoCal-H. Since a commercially available read-out system no longer seemed possible, the attention of the group turned to custom-made read-out systems based on two different ASICS, the VMM3a and the H2GCROC. After both of these ASICS had shown great potential in initial tests in the spring and summer of 2023, fully-fledged readouts for prototype II were planned for tests during the beam test of September 2023 along with the DT5202 that would act as a benchmark system. However, due to issues in the construction of the H2GCROC read-out boards, the test of this particular system had to be postponed, leaving only the VMM3a hybrid boards to be held up against the CAEN DT5202 FEBs.
Through extensive analysis of the data acquired using these different readout systems assessing the capabilities of the different boards, including among other parameters their sensitivity, consistency, and energy resolutions. Based on the results of this evaluation, the VMM3a hybrid boards must be deemed to be on par with if not superior to the CAEN DT5202 in every category, despite not having been tested as rigorously. However, whether the VMM is to remain the favorite will be addressed during the upcoming beam test at the end of May for which the readout board based on the H2GCROC is scheduled to be ready for test. Also during this beam test the CAEN DT5202 might receive a lifeline in the form of the CAEN DT5215 collector board, a new device designed to handle the input of multiple CAEN FEBs at once.

Field of study

Quantum Physics

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