

Universal performance analysis of the DUNE Front-End Mother Boards for quality control

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Abstract

The digitization of signals from a liquid Argon Time Projection Chamber(LArTPC) are performed by front-end motherboards(FEMBs) in DUNE and protoDUNE. Three series of Application Specific Integrated Chips (ASIC) are mounted on these boards: LArASIC, ADC and COLDATA. The LArASIC chips amplify the signals; the ADC digitizes them and the COLDATA is responsible for the communication between the board itself and the outside world. A quality control(QC) test of each component and the board is therefore required. This study is about the QC test of the FEMBs both at room temperature(RT) and at cold using liquid nitrogen(LN_2). For the selection of good FEMBs to be used, we already have some scripts collecting the data and analyzing the performance of each board during the test. Our goal in the current study is to analyze the data of the good FEMBs and producing a summary of their performance. The results we obtained show that the noise at RT is higher than at liquid nitrogen. We also noticed a slightly high power consumption of the LArASIC at LN_2 than at RT if the single-ended with enabled buffer or the single-ended to differential with buffer enabled output is used. Finally, the gain of the FEMBs at LN_2 is slightly higher than at RT. More parameters will be included in this analysis so that in the future, we will be able to set an acceptance range for the FEMB whether it failed or passed the QC.