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Diamond Detector Measurements at the NEAR Station of the n_TOF facility at CERN

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The new experimental area of the n_TOF facility at CERN, namely NEAR [1], has been built at a very short distance from the Pb spallation target (approximately 2.5 m) in order to take advantage of the extremely high neutron fluence expected and perform various challenging measurements for numerous applications. In this experimental area, due to the high instantaneous flux, only passive techniques, such as the multiple foil activation technique, have been utilized to characterize the neutron flux. However, diamond exhibits very promising properties for in beam neutron detection, leading to the widespread usage of diamond detection systems in radiation applications, particularly in neutron induced reaction studies and neutron fluence measurements ([2],[3]). In this work, a newly built single crystalline diamond detector and associated electronics were developed by the CIVIDEC Instrumentation [4], aiming to measure the neutron flux in the harsh environmental conditions of the NEAR station. It was essential to perform numerous experiments in order to test the response of the detector and the electronics as well as to determine the optimized experimental set-up. One test was performed at the EAR2 and the following three at the NEAR station, where an in-beam measurement was attempted for the first time. These challenging measurements lasted 3 months, spread out in 2022 and 2023, and required frequent visits at CERN, supported by ARIEL. The preliminary results of these tests will be presented and discussed in this presentation.

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