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Performance Evaluation of Plastic Scintillator-Based Calorimeter Modules for Neutron Detection in the CBM Experiment

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To enhance the neutron detection capabilities of the CBM experiment, the use of existing calorimeter modules based on plastic scintillators with photomultiplier tubes (PMTs) has been proposed. These modules are designed to be placed behind the Forward Spectator Detector (FSD), with expected neutron detection efficiencies of approximately 30%. Each module has a hexagonal shape, with a length of 45 cm and a side length of about 8 cm. The complete detector, comprising 86 modules, covers an area of approximately 1.3 m².

A test setup consisting of a package of 7 modules, along with two veto scintillator plates for charged particle separation, has been prepared and installed at the mCBM setup. This configuration aims to investigate the performance of the proposed neutron detector. During the mCBM test beam times in 2024, the detector was operational, utilizing the DiRICH readout system to feed data into the mCBM data acquisition (DAQ) system.

This presentation will discuss the beamtime results in comparison with Monte Carlo simulations, focusing on the detector's performance in proton-induced reaction channels with hydrogen and deuteron targets.

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