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Development of the electron detectors and readout electronics for BRAND experiment

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The correlation coefficients of neutron and nuclear beta decays are a distinctive tool to probe physics beyond the standard model (BSM) in a low-energy regime. The BRAND is a unique experimental initiative aiming at the simultaneous measurement of 11 correlation coefficients (a, A, B, D, H, L, N, R, S, U, and V) of neutron decay, with an emphasis on H, L, S, U, and V, which have not been attempted so far. These correlation coefficients necessitate a measurement of four vectors: the momentum and spin of the electron, as well as the momentum of the proton and the spin of the neutron~\cite{brand}. The BRAND setup involves electron and proton detection systems. The electron detection system consists of a MultiWire Drift Chamber (MWDC)~\cite{det2,det3}, scintillator detectors for energy measurement and triggering purposes, and a Mott scattering target for electron spin analysis. The proton detection system composes an accelerating electric field, an electron-to-proton converter foil, and a thin scintillator with a SiPM readout. The decay vertex will be reconstructed using the tracker information and proton hit position, as well as the time-off-flight determined in the proton detector.

The BRAND employs gas and plastic scintillator-based detectors, incorporating specially designed front-end electronics allowing for the digitization of signals from the wires, photomultiplier tubes, and silicon photomultipliers, exclusively by multi-hit TDC (CAEN V1190). Such a solution significantly reduces the cost of the electronics and greatly simplifies the triggering logic. The characterization of recently developed prototypes, including the achieved performance, will be presented.

Collaboration

BRAND Collaboration

Role of Submitter

I am the presenter

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