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BRAND – A DETECTION SYSTEM FOR BETA DECAY CORRELATION MEASUREMENT

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The BRAND experiment aims at the search of Beyond Standard Model (BSM) physics via measurement of exotic components of the weak interaction. For this purpose, eleven correlation coefficients of neutron beta decay will be measured simultaneously. Seven of them: H, L, N, R, S, U, and V, are sensitive to the transverse polarization of electrons from free neutron decay. Coefficients: H, L, S, U, and V were never attempted experimentally before. The BRAND detection system is oriented for the registration of charged products of the beta decay of polarized, free neutrons. With the measurement of the 4-momenta of electron and proton, the complete kinematic of the decay will be determined. Moreover, the transverse spin component of the electron will be measured via Mott scattering which is a key factor to probe BSM weak interaction.

The electron detection system features both tracking and energy measurement capability. It is also responsible for the determination of the electron spin orientation. For the 3D tracking, a low density, helium-based drift chamber of a hexagonal cell structure that is optimized for beta particles is used. The Mott polarimeter is an integral part of the tracker. It is realized by a thin Pb-foil as a Mott-scatterer installed inside the drift chamber and two plastic scintillators providing the trigger and energy of the scattered electrons.

A challenging aim of the detection of low-energy protons from the beta decay is performed with a system, which involves the acceleration and subsequent conversion of protons into bunches of electrons. These ejected electrons (~25 keV) from a thin LiF layer are finally registered in a position-sensitive thin plastic scintillator readout with the arrays of SiPMs.

(Full abstract in the attached PDF file)

Collaboration

BRAND collaboration

Primary author: Ms DHANMEHER, Karishma (Institute of Nuclear Physics, Polish Academy of Science.)

Presenter: Ms DHANMEHER, Karishma (Institute of Nuclear Physics, Polish Academy of Science.)

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