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Detection of collinear high energetic di-photon signatures with Micromegas Detectors

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The search for weakly interacting, light particles that couple to photons received significant attention in recent years. When those particles are produced at high energies, they may decay in two collinear photons that can be detected by an electromagnetic calorimeter system. The typical dominant background in searches for those high energetic weakly particles are single, high energetic photons, which leave similar signatures in a standard calorimeter system.
One promising approach to separate signal from background events is to employ a dedicated pre-shower detector in front of the calorimeter that can distinguish one- and two-photon signatures. In this work we present a conceptual design of such detector which is able to separate one from two collinear photon signatures. For energies above 300 GeV, it allows for efficiencies between 20% to 80% for two photons separated by 100 µm to 2000 µm, respectively, and a background rejection of more than 90%. Our pre-shower detector design has an active surface area of 10 x 10 cm^2, a depth of 230 mm and is based on Micromegas detectors operated with Ar:CO_2 (93% : 7%), thus offering a cost effective solution.

Collaboration

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