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Higher Energy CROSSTEST

Proposals (expression of interest)
We propose a test experiment on the EJ276 and EJ276G scintillators, to study their properties and peculiarities in order to realize a new challenging neutron and charge particle detector device.
The study and construction of such a detector has been recently approved and financed in the framework of the national PRIN2020 funding call. The name of this project is ANCHISE (Array for Neutron and Charged particles with HIgh linear momentum SElection), it is supported by the CSNIII - INFN and it involves many of the proposers of this test.
In particular, we want to extend at higher energy our investigations, already measured with 4.5 MeV neutrons at CN facility at LNL (CROSSTEST exp.), with further studies on the performance achievable in shape discrimination in gamma-neutron separation, on the energy calibration linearity, on the timing of the plastic scintillators and on the cross talk effect. We want also make a Time of Flight (ToF) neutron energy measurement test and a neutron efficiency measurement. We well use 6 clusters of NArCoS (Neutron Array for Correlation Studies), made by 24 elementary cubic cells of 3 cm sides. Four stacked cells compose one segmented single cluster having dimension of 3cm x 3cm x 12cm in order to test its preliminary version of the prototype of the detector. In CROSSTEST@LNL exp., performed in November 2023, we studied the crosstalk probability (same neutron detected in two different cells) at the energy of 4.5 MeV at CN facility, measuring a traverse crosstalk probability (to the respect of the beam direction) of about 0.1% and a parallel one of about 0.2%; both crosstalk probability resulted lower than the simulated value by means GEANT4 and MCNPX simulation toolkits (E. V. Pagano et al., NIM in preparation). With this proposal we request to use the proton beam from the new cyclotron at LNL at an energy of 35 MeV of about 200 enA of intensity, impinging on a LiF target in order to have neutrons in a range from 15 to 30 MeV to measure crosstalks as a function of energy (steps of 5 MeV), neutron detection efficiency (measuring the 7Be and the neutron in coincidence), n-⍰ PSD performances at higher energies, linearity of the energy calibration at high
energy, timing properties and Time of Flight (ToF) test of the neutron energy measurements. In order to perform the experiment we well need the experimental hall equipped of a flanged small thin walls vacuum scattering chamber to put inside the LiF target ad a Si detector in order to measure the 7Be in coincidence with the neutrons with NArCoS in air.

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