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Development of a fast and modular trans-Stilbene multi-detector array for measuring elastic and inelastic neutron cross-section channels at n_TOF(CERN)

We evaluated the response of an 8-module trans-stilbene scintillator array [1] in detecting (n,n) and (n,n') reactions in neutron scattering experiments. The measurement was performed at the neutron time-of-flight facility (n_TOF) at CERN in Experimental Area 1 (EAR1) [2], based on prior research at EAR2 [3]. The primary focus is to extend these measurements to the elastic and inelastic channels [2]. In this context, we present results on the n+12C elastic and inelastic scattering channels, and a new ultra-fast detector prototype based on the same readout technology.

We demonstrated the capabilities of trans-Stilbene detectors, according to the excellent n/gamma Pulse-Shape Discrimination, in performing (n,el) cross-section measurements at n_TOF. These technical advancements will establish a benchmark for measuring in the MeV n-energy region, where the critical presence of the gamma-flash, combined with a compressed Time-of-Flight dynamics, makes the measurement quite challenging, thus representing a technical reference for the post-LS3 n_TOF measurement campaign at CERN [4].

References

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- [3] n TOF collaboration, n TOF, CERN-INTC-2023-034 / INTC-I-254, available online at <https://cds.cern.ch/record/2856350/files/INTC-I-254.pdf>
- [4] n TOF collaboration, n TOF, CERN-INTC-2023-072 / INTC-I-266, available online at <https://cds.cern.ch/record/2872442/files/INTC-I-266.pdf>

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