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MANY: measurement of (alpha,n) thick target yields and cross-sections

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Neutrons produced in α-induced reactions play important roles in fields such as nuclear astrophysics, neutron background in underground laboratories, fission and fusion reactors and non-destructive assays for non-proliferation and spent fuel management applications. However, most of the available data on (α,n) reactions was measured decades ago, is incomplete and/or present large discrepancies not compatible with the declared uncertainties. Thus, new measurements addressing current needs are required [1, 2]. To that end the Measurement of Alpha Neutron Yields and spectra (MANY) collaboration was formed.

This contribution reports on the commissioning of the modular neutron counter miniBELEN at the Centro Nacional de Aceleradores (CNA). This detector has already been succesfully used to measure the 27Al(α,n)30P reaction yields and cross-sections at the Centro de Micro-Análisis de Materiales (CMAM). The performance of the system at this facility and its readiness for (α,n) measurement campaigns will be described.

In addition, we present first results on auxiliary detectors developed to complement miniBELEN. The recently characterized Ymon detector provides neutron flux measurements with angular sensitivity and exhibits a flat response in the ~1 keV to 8 MeV energy range. We also introduce a highly segmented LaCl3 array under development, designed to be embedded in future neutron counters to enable hybrid neutron–gamma detection. Beyond α–γ studies, this capability might allow the extraction of partial cross sections feeding different excited states in (α,n) reactions, thereby enhancing the experimental reach of MANY.

[1] S.S. Westerdale et al, IAEA technical meeting INDC(NDS)-0836 (2021)
[2] A. Junghans et al., IAEA technical meeting INDC(NDS)-0894 (2023)
[3] N Mont-Geli et al. EPJ Web of Conferences 284 (2023) 06004

Abstract

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