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Measurement of thick target total neutron yields for the 27Al(alpha,n)30P reaction at CMAM using the miniBELEN neutron counter

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Abstract

Abstract
Neutron production through α-induced nuclear reactions is relevant in several fields. Specifically, (α,n) reactions are interesting in nuclear astrophysics as a source of neutrons for the slow neutron capture nucleosynthesis (the s-process) [TAI16] and in the α-particles capture process (the α-process) [WOO92, BLI17]. Other fields of interest include the neutron-induced background in underground laboratories [BET10], which is a crucial issue in low counting rate experiments, and in nuclear facilities such as nuclear reactors and particle accelerators [MUR02]. Currently, evaluated data is available only for a limited number of isotopes and the databases present large discrepancies in some cases.

The Measurement of Alpha Neutron Yields and spectra (MANY) collaboration is a coordinated effort by several Spanish research groups with the aim to carry out measurements of (α,xn) reactions yields, cross-sections and spectra. The project relies on the use of α-beams produced by the accelerators at Centro de Micro-Ánalisis de Materiales (CMAM, Madrid, Spain) and Centro Nacional de Aceleradores (CNA, Seville, Spain).

In this work we report the results of the measurement of thick target total neutron yields from the 27Al(alpha,n)30P reaction. This measurement has been part of the commissioning of the miniBELEN detector, a novel modular and transportable neutron long counter, and the 45º beam-line at CMAM for the MANY program in (alpha,n) reactions. The design and the experimental characterization of miniBELEN using 252Cf neutron sources will be also presented.

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