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Structure beyond the neutron threshold in N = 50 nuclei using neutron detection techniques at ALTO

As nuclei get richer in neutrons, the Q-value for beta-decay gets larger while the neutron separation energy decreases. Consequently, for large enough N/Z ratios, the daughter nucleus can decay by emitting one to several neutrons. Directly studying states above the neutron separation energy is an experimental challenge as it requires neutron detectors that have a good energy resolution while maintaining a good efficiency. This has lead to a lack of knowledge of these states, and several properties linked to the beta-delayed neutron emission are therefore not well understood or predicted. This has a significant impact on the modeling of the astrophysical "r-process" in which this decay highly occurs. The study of these states and their structure is part of a physics program based at the ALTO facility in Orsay, France. The beta-delayed two-neutron emission of Gallium 84 has been investigated using the Helium 3 neutron counter TETRA, and for the first time, a fully microscopic semi-quantitative approach based on "doorway-states" has been used to describe the beta-delayed neutron emission two-step process. Additionally, the response function of the detector TETRA has been thoroughly studied using Monte-Carlo simulations, and new methods have been developed allowing to use this detector to obtain gross information on the neutron energy spectra even though it was not initially designed for this purpose.

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