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A Study of Gd-based Parallel Plate Avalanche Counter for Thermal Neutrons by MC Simulation

In this work, we demonstrate the feasibility and characteristics of a single-gap parallel plate avalanche counter (PPAC) as low energy neutrons detector based on the Gd-converter coating. The incident low energy neutrons upon falling on the Gd-converter surface, produce internal conversion electrons, which are evaluated and detected. For estimating the performance of the Gd-based PPAC, a simulation test has been taken using GEANT4 Monte Carlo code. In this work, we demonstrate the feasibility and characteristics of a single-gap parallel plate avalanche counter (PPAC) as low energy neutrons detector based on the Gd-converter coating. The incident low energy neutrons upon falling on the Gd-converter surface, produce internal conversion electrons, which are evaluated and detected. For estimating the performance of the Gd-based PPAC, a simulation test has been taken using GEANT4 Monte Carlo code. The detector's response as a function of incident neutron energies in the range of $E_n = 25$ meV to $E_n = 100$ meV, has been evaluated with two different physics lists e.g., the QGSP_BIC_HP and the QGSP_BERT_HP. Using the QGSP_BIC_HP physics list and with 5 μm converter thickness, the detection efficiencies of 11.8%, 18.48% and 30.28% have been achieved for the forward-, backward- and as a total converter-based PPAC response, respectively. On the other hand, considering the same converter thickness and detector configurations, with the QGSP_BERT_HP physics list the efficiencies were 12.19%, 18.62% and 30.81% respectively. A brief discussion on the results is also performed.

quote your primary experiment

PPAC, Thermal Neutrons

Author: Prof. MUHAMMAD, Jamil (IAP, HEP Lab: Konkuk University, Seoul, KOREA)

Co-authors: Dr FARZANA, Ahmad (Konkuk University); KIM, H.G. (IAP, High Energy Physics Lab, Department of Physics, Konkuk University); Prof. RHEE, J. T (IAP, HEP Lab: Konkuk University, Seoul, KOREA); Prof. JEON, Y. J (Konkuk University)

Presenter: Prof. RHEE, J. T (IAP, HEP Lab: Konkuk University, Seoul, KOREA)

Track Classification: Gaseous Detectors