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Development work for The Detector Array for Energy Measurement of Neutrons (DAEMON)

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As one moves away from stable isotopes and deeper into the neutron-rich region, the likelihood of β -delayed neutron (βn) emission decay increases. The ability to understand the neutron emission probabilities and the neutron energy spectrum can reveal details of the nuclear structure that a conventional β -decay study using only γ -ray detection cannot. We propose to build the Detector Array for Energy Measurements of Neutrons (DAEMON) that will employ the time-of-flight technique to enable high-resolution energy measurements of the neutrons emitted following βn emission. The initial trials, performed at the University of Guelph, testing the rudimentary geometries of EJ200 plastic scintillators and various electronic parameters of silicon photomultiplier (SiPM) arrays for the foundation of DAEMON will be presented. Upon successful comparison of data taken with γ sources with GEANT4 simulations, the DAEMON prototype will be tested with monoenergetic neutron beams at the University of Kentucky Accelerator Laboratory. Used in conjunction with the GRIFFIN Decay Station at TRIUMF in Vancouver, BC, DAEMON will enable βn studies not currently feasible at the facility, initiating a road to strong international collaborations. From shaping the abundance curve of the astrophysical rapid neutron capture process, as well as controlling the neutron induced fission in nuclear reactors, a broad range of applications will be addressed through improved knowledge of the neutron emission spectrum that this new detector will bring.

Keyword-1

DAEMON

Keyword-2

β -delayed neutron emission

Keyword-3

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