

The Neutron Scattering Model *MENATE_R* for GEANT4 and the Design Study for a New Neutron Detector Array for EURISOL

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As part of the design study for EURISOL, we have been investigating the need for a new “neutron wall” type detector array for use in experiments involving nuclei near and beyond the neutron dripline. It was advantageous to develop the Monte-Carlo simulation for the neutron wall within the GEANT4 toolkit [1] because it was easy to define and adjust the parameters and the materials of the wall. However, we also found that the neutron scattering models that pre-existed within the GEANT4 toolkit were insufficient for our needs. Thus, we have developed the neutron scattering model “*MENATE_R*”, which is an updated version of code *MENATE* [2] translated into C++ for use with GEANT4 and updated/improved with elements other neutron scattering codes such as *DECOI* and *DEMONS*. With this neutron scattering model, we are able to simulate the total cross sections and angular distributions of neutron scattering on ^1H and ^{12}C between $1 \text{ MeV} \leq E_n \leq \sim 300 \text{ MeV}$. Applying this model, one can reproduce the efficiency of existing detector modules such as DEMON and EDEN, and also have a reasonable prediction for the effects of “cross-talk” and “out-scattering” on the efficiency and resolution of a detector array.

The results obtained with “*MENATE_R*” and the simulation “*PINKFLOYD*” for the development of the new neutron-wall detector array will be presented. The design of the wall is still in progress, but the effects of certain design specifications such as wall bar dimensions, timing, and distance from the target to the array will be discussed.

[1] S. Agostinelli et al., Nucl. Instr. and Meth. A 506 (2003) 250-303.

[2] P. Désesquelles et al., Nucl. Instr. and Meth. A 307 (1991) 366.

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