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Exotic and Stable Nuclear Beam Neutron Spectroscopy without Time-of-Flight: A DSP-Based Deuterated Scintillator Array MICHAEL FEBBRARO, FREDERICK BECCHETTI, RAMON TORRES-ISEA, University of Michigan, ALAN HOWARD, AMY ROBERTS, JIM KOLATA, University of Notre Dame — Due to the limited beam intensity and other factors associated with exotic, short-lived secondary radioactive nuclear beams (RNB), we have developed a multi-element deuterated liquid scintillator array for the study of reactions involving neutrons. The system is well suited for RNB experiments involving neutrons such as the study of (p,n), (d,n), and (3He, n) reactions with neutron energy above 5 MeV and well separated states of interest. Because time-of-flight (ToF) is not necessary [1], the detectors can be located in close proximity to the reaction chamber allowing for good angular coverage and absolute detector efficiency compared to traditional ToF systems. The use of Digital Pulse Shape Discrimination (DPSD) for neutron spectroscopy experiments without ToF has been demonstrated and preliminary results from stable and exotic beam testing conducted at the UM-UND Twin-Sol LE-RNB facility lat UND will be reported. In addition, preliminary results from the new hydrogen-plastic scintillator Eljen-399 capable of neutron/gamma discrimination will also be discussed. This work is supported by NSF grant PHY 0969456.

[1] "Evaluation of Large Deuterated Scintillators for Fast Neutron Detection ....," M. Ojaruega, et al., Nucl. Instrum. Methods A652 (2011) 397-399.

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