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2.38 Average neutron time-of-flight instrument response function inferred from single D-T neutron events within a plastic scintillator

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The bulk ion-temperature and neutron reaction history are important characteristics of a fusion plasma. Extracting these from a measured neutron-time-of-flight (nTOF) signal, either by convolution or de-convolution methods, requires accurate knowledge of the instrument response function (IRF). This work describes a novel method for obtaining the IRF directly for single D-T neutron interactions by utilizing n-alpha coincidence. The $t(d, \alpha)n$ nuclear reaction was produced at Sandia National Laboratories' Ion Beam Laboratory using a 300-keV Cockcroft-Walton generator to accelerate a 2- μ A beam of 175-keV D⁺ ions into a stationary ErT2 target. The average neutron IRF was calculated by taking a time-corrected average of individual neutron events within an EJ-228 plastic scintillator. The scintillator was independently coupled to two photo-multiplier tubes operated in current-mode: a Hamamatsu 5928 mod-5 and a Photek PM240. The experimental set-up and experimental results will be discussed. Work supported by DOE NNSA contract DE-NA0003525.

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