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4.52 LaBr3 detectors for DD neutron yield measurements

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A LaBr3 scintillator-based neutron detection system has been tested at several neutron sources for evaluation as a DD neutron yield measurement. DD fusion neutrons (2.45 MeV) undergo (n,n') reactions in Br-79m in the crystal, which then emits a 208 keV gamma ray that is detected. Because the gamma originates in the crystal, detection efficiency is high. In this work the detector was tested in three facilities: the National Ignition Facility (NIF) and two Dense Plasma Focuses (DPFs). By testing at different facilities, a linear response to yield confirmed the detector is suitable as a yield diagnostic for neutron fluences ranging from 1x10ˆ3 to 1x10ˆ5 n/cmˆ2. At NIF the response was cross-calibrated to NTOF yields. Later it was tested at a DPF, where it was compared to a He-3 detector. In the linear range of the He-3 detector the LaBr3 was proportional, although by a different constant due to the difference in neutron scattering between the DPF and NIF. A similar experiment was carried out at another DPF with higher yields. A block of Y, which has a higher activation energy threshold, was tested as a proof-of-concept at the high-yield DPF and had encouraging results.

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