HTPD 2018

Contribution ID : **181**   Type : **not specified**

4.4 Measurements of Bulk-Fluid Motion in Direct-Drive Implosions

Monday, 16 April 2018 20:30 (120)

A newly developed neutron time-of-flight diagnostic with an ultrafast instrument response function has been fielded on the OMEGA laser in a highly collimated line of sight. By using a small plastic scintillator volume, the detector provides a narrow instrument response of ˜2 ns FWHM while maintaining a large signal-to-noise ratio for neutron yields between 1010 to 1014. The OMEGA Hardware Timing System is used along with an optical fiducial to provide an absolute neutron time-of-flight measurement. The fast instrument response enables the accurate measurement of primary DT neutron peak shape while the optical fiducial allows for an absolute neutron energy measurement. Evidence of bulk-fluid motion in cryogenic targets is presented with measurements of the neutron energy spectrum. An extension of this method to four lines of sight is discussed, which would enable the measurement of the hot-spot center-of-mass velocity. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944.

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Session Classification :   Session #4, Monday Night Poster Session