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6.39 The particle time-of-flight (pTOF) detector for high-yield (>1016) implosions at the National Ignition Facility

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The particle time-of-flight (pTOF) detector is a polycrystalline CVD-diamond photoconducting diode, which has been used to measure the shock-and compression- bang time using fusion products from DD, D3He or DT reactions in Inertial Confinement Fusion implosions at the National Ignition Facility (NIF). Current implementations of the pTOF detector have been able to provide these measurements for nuclear yields in the range of 1010-1015. However, numerous NIF implosions have generated yields which exceed the sensitivity range of pTOF. A bang time measurement for a NIF implosion with a yield of 5×1016 using a 1 cm diameter pTOF detector requires a maximum sensitivity of 5×10-11 V ns per DT neutron. In this contribution, we present the path for implementing a low-sensitivity pTOF detector for bang-time measurements in high-yield (˜1016) implosions using a single crystalline diamond. Data presented from recent OMEGA implosions will test if single crystal diamond detectors can achieve the desired sensitivity thresholds for NIF. Having bang time measurements will be essential in our effort of understanding the timing difference between x-ray and nuclear bang-times in ICF implosions. This work was supported in part by DOE and LLNL (Subcontract No. B613027).

Primary author(s) : ADRIAN, P. J. (MIT)

Co-author(s) : KABADI, N. (MIT); SIO, H. (MIT); JOHANSON, M. (MIT); FRENJE, J. (MIT); LAHMANN, B. (MIT); SIMPSON, R. (MIT); PETRASSO, R. (MIT); KNAUER, J. (LLE); GLEBOV, V. (LLE)

Presenter(s) : ADRIAN, P. J. (MIT); KABADI, N. (MIT); SIO, H. (MIT); JOHANSON, M. (MIT); FRENJE, J. (MIT); LAHMANN, B. (MIT); SIMPSON, R. (MIT); PETRASSO, R. (MIT); KNAUER, J. (LLE); GLEBOV, V. (LLE)

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