DESIGN OF A NORTH POLE NEUTRON TIME-OF-FLIGHT (NTOF) SYSTEM AT NIF

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For several years now, observed asymmetries of the NIF cryogenic DT layered implosions have been discussed at great length because of their impact on the performance (yield) of these experiments. Recently, a fully 3D simulation, with a significant P1 asymmetry imposed upon it, confirmed drastic anisotropies in ion temperature, down-scattered neutron ratios, and neutron activation as well as DD and DT neutron peak shapes, consistent with observed data[1]. The changes in peak shapes can be so prominent that a new parameterization, that includes elements of skew and kurtosis, was created to better describe the emerging neutron spectrum in velocity space[2] and is currently being incorporated into the NTOF data analysis[3]. Concurrently, the flange neutron activation diagnostic (FNAD) has shown that the cryogenic layered implosions exhibit a systematic collection of fuel mass at the north pole, but no other neutron detector is located there to confirm this observation.

As a result, the NIF has undertaken deployment of a spectroscopic NTOF detector above the arctic circle at NIF. The detector will be located at latitude 72° (18-304) and 21.6 m from the TCC. The detector package itself is identical to the other three LOS of spectroscopic neutron detectors (90-174, 116-316, and 151-56) that are based on low-mass "JacBlac" housing and an octagonally-shaped, bibenzyl organic scintillator 10cm across by 2.5cm thick. The LOS penetrates the target chamber, three floors, the target bay ceiling, and is eventually delivered to a hut on the roof of the NIF building. The neutron beam is collimated using three collimators: a primary collimator located on the port penetration into the target chamber, and two secondary "clean-up" collimators located in the floor and ceiling of the "attic" air plenum in the target bay. This presentation will summarize the motivation for placing a detector at this position, the design of LOS and the detector as it stands, and it's expected performance on DT cryogenic layered implosions such as the HiFoot series.

[1] B. Spears and D. Munro *et al.* (2015) in preparation
[2] D. Munro *et al.* (2015) in preparation
[3] R. Hatarik *et al.* (2015) in preparation

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