Contribution ID: **1221** Type: **Oral**

Time-Dependent Helical Magnetic Field Effects on Cylindrical Liner Implosions

Wednesday 26 June 2019 16:15 (15 minutes)

Liner implosions are susceptible to instabilities like the magneto Rayleigh-Taylor (MRT) instability. There are several ways to mitigate instabilities such as MRT. One such method uses the rotating magnetic field of a dynamic screw pinch (DSP), which can be generated using a helical return-current structure. The DSP method has been examined in simulation [1] and now in experiment as well. Using Cornell's COBRA pulsed power driver, both straight and helical return current paths were tested on imploding thin-foil liners (made from 650-nm-thick aluminum foil). Each implosion was driven by a current pulse that rose from 0 to 1.1 MA in 100 ns. For the helical return-current structure tested, this current corresponds to an axial magnetic field of up to 13 T. These experiments revealed remarkable differences in the instability structures between the two cases; i.e., helical modes were observed for the DSP case and were absent for the straight (standard) z-pinch case. The results and analysis of the instability development for both cases will be presented.

1. P.F. Schmit, et al., (2016). Controlling Rayleigh-Taylor Instabilities in Magnetically Driven Solid Metal Shells by Means of a Dynamic Screw Pinch. Phys. Rev. Lett., 117, 205001.

- This work was supported by the National Science Foundation under Grant No. PHY-1705418 of the NSF-DOE Partnership in Basic Plasma Science and Engineering. COBRA support was provided by the NNSA Stewardship Sciences Academic Programs under DOE Cooperative Agreement DE-NA0003764.

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Session Classification: 4.6 Fast Z Pinches II

Track Classification: 4.6 Fast Z Pinches