The PLX-α Plasma Guns: Progress and Plans

F.D. WITHERSPOON, S. BROCKINGTON, A. CASE, E. CRUZ, M. LUNA, HyperV Technologies Corp., Y.C. FRANCIS THIO, HyperJet Fusion Corporation, AND THE LANL PLX-α TEAM — The ALPHA coaxial plasma guns are being developed to support a 60-gun scaling study of spherically imploding plasma liners as a standoff driver for plasma-jet-driven magneto-inertial fusion (PJMIIF) [1]. Seven complete guns have been delivered to LANL with 6 guns currently undergoing simultaneous test firings on PLX. The guns are designed to operate over a range of parameters: 0.5-5.0 mg of Ar, Ne, N₂, Kr, and Xe; 20-60 km/s; $\sim 2 \times 10^{16} \text{ cm}^{-3}$ muzzle density; and up to 7.5 kJ stored energy per gun. Each coaxial gun incorporates a fast dense gas injection and triggering system, a compact low-weight pfn with integral sparkgap switching, and a contoured coaxial gap to suppress the blow-by instability [2]. Optimizing parameter scans performed at HyperV have achieved: $\sim 4$ mg at $>50$ km/s and length of $\sim 10$ cm. Peak axial density 30 cm from the muzzle is $\sim 2 \times 10^{16} \text{ cm}^{-3}$. We will provide an overview of the experimental results, along with plans for further improvements in reliability, maintainability, fabricability, and plasma jet performance, with the latter focused on further improvements in the fast gas valve and the ignitors. [1] Hsu et al., IEEE Trans. Plasma Sci. 40, 1287 (2012). [2] Witherspoon et al., Rev. Sci. Instr.

This work supported by the ARPA-E ALPHA Program under contract DE-AR0000566 and Strong Atomics, LLC.

Franklin Witherspoon
HyperV Technologies Corp.

Date submitted: 14 Jul 2017
Electronic form version 1.4