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**Scaling the Shear-flow Stabilized Z-pinch to Reactor Conditions**[1]

H.S. MCLEAN, A. SCHMIDT, Lawrence Livermore National Laboratory, U. SHUMLAK, B.A. NELSON, R.P. GOLINGO, E. CLEVEAU, University of Washington — We present a conceptual design along with scaling calculations for a pulsed fusion reactor based on the shear-flow-stabilized Z-pinch device. Experiments performed on the ZaP device [1], at the University of Washington, have demonstrated stable operation for durations of 20 usec at ∼100kA discharge current for pinches that are ∼1 cm in diameter and 100 cm long. The inverse of the pinch diameter and plasma energy density scale strongly with pinch current and calculations show that maintaining stabilization durations of ∼7 usec for increased discharge current (∼15x) in a shortened pinch (10 cm) results in a pinch diameter of ∼200 um and plasma conditions that approach those needed to support significant fusion burn and energy gain (Ti∼30keV, density∼3e26/$m^3$, ntau∼1.4e20 sec/$m^3$). Compelling features of the concept include operation at modest discharge current (1.5 MA) and voltage (40kV) along with direct adoption of liquid metals for at least one electrode—technological capabilities that have been proven in existing, commercial, pulse power devices such as large ignitrons.

[1] U. Shumlak, et. al., Nucl. Fusion 49 (2009) 075039.

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