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A GDT-based fusion neutron source for academic and industrial applications J. K. ANDERSON, C. B. FOREST, V. V. MIRNOV, E. E. PETERSON, R. WALEFFE, J. WALLACE, UW-Madison, R. W. HARVEY, CompX
— The design of a fusion neutron source based on the gas dynamic trap (GDT) configuration is underway. The motivation is both the ends and the means. There are immediate applications for neutrons including medical isotope production and actinide burners. Taking the next step in the magnetic mirror path will leverage advances in high-temperature superconducting magnets and additive manufacturing in confining a fusion plasma, and both the technological and physics bases exist. Recent breakthrough results at the GDT facility in Russia demonstrate stable confinement of a beta˜60% mirror plasma at high Te (˜1keV). These scale readily to a fusion neutron source with an increase in magnetic field, mirror ratio, and ion energy. Studies of a next-step compact device focus on calculations of MHD equilibrium and stability, and Fokker-Planck modeling to optimize the heating scenario. The conceptualized device uses off-the-shelf MRI magnets for a 1 T central field, REBCO superconducting mirror coils (which can currently produce fields in excess of 30T), and existing 75 keV NBI and 140 GHz ECRH. High harmonic fast wave injection is damped on beam ions, dramatically increasing the fusion reactivity for an incremental bump in input power. MHD stability is achieved with the vortex confinement scheme, where a biasing profile imposes optimal ExB rotation of the plasma. Liquid metal divertors are being considered in the end cells. Work supported by the Wisconsin Alumni Research Foundation.

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