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MagLIF performance on the Z-machine: simulations of present and future experiments

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The MagLIF (Magnetized Liner Inertial Fusion) concept[S.A. Slutz et al. Phys. Plasmas 17, 056303,2010] has produced 3.e12 DD neutrons on the Z-machine [M.R. Gomez et al. Phys. Rev. Lett. 113, 155003, 2014]. 2D simulations using the measured fuel preheat,800 J, and drive current, 17 MA, predict 6.e12 DD neutrons. We show that even better agreement is obtained when the effect of electrode material mixed into the fuel is included. Calculations indicate that mix should have only a small effect on the yield if all electrode surfaces are constructed of beryllium, lithium or frozen isotopes of hydrogen. Numerical simulations indicate that much higher yields should be possible on Z if the current and fuel preheat can be increased [S.A. Slutz et al. Phys. Plasmas 23, 022702, 2016]. The existing MagLIF experiments had low drive currents (< 18 MA) due to the high inductance of the power feed, which induces current loss in the device that adds current from four magnetically insulated transmission lines. We present simulations of low inductance MagLIF designs, which indicate that the drive current should be increased to 22 MA with a predicted fusion yield of 2.e14 DD neutrons. This would correspond to a 50 kJ DT yield and a fuel gain greater than unity.

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