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Optimizing Dense Plasma Focus Neutron Yields With Fast Gas Jets MATTHEW MCMAHON, ELIZABETH STEIN, DREW HIGGINSON, CHRISTOPHER KUENY, ANTHONY LINK, ANDREA SCHMIDT, Lawrence Livermore Natl Lab — We report a study using the particle-in-cell code LSP to perform fully kinetic simulations modeling dense plasma focus (DPF) devices with high density gas jets on axis. The high-density jets are modeled in the large-eddy Navier-Stokes code CharlesX, which is suitable for modeling both sub-sonic and supersonic gas flow. The gas pattern, which is essentially static on z-pinch time scales, is imported from CharlesX to LSP for neutron yield predictions. Fast gas puffs allow for more mass on axis while maintaining the optimal pressure for the DPF. As the density of a subsonic jet increases relative to the background fill, we find the neutron yield increases, as does the variability in the neutron yield. Introducing perturbations in the jet density via super-sonic flow (also known as Mach diamonds) allow for consistent seeding of the m=0 instability leading to more consistent ion acceleration and higher neutron yields with less variability. Jets with higher on axis density are found to have the greatest yield. The optimal jet configuration and the necessary jet conditions for increasing neutron yield and reducing yield variability are explored. Simulations of realistic jet profiles are performed and compared to the ideal scenario. This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 and supported by the Laboratory Directed Research and Development Program (15-ERD-034) at LLNL.

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