Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Ultrahigh-speed plasma sources and liner compression of high-temperature plasma P.J. TURCHI, Los Alamos National Laboratory — The Open Fire series of multi-megampere experiments[1] on the Shiva Star capacitor bank achieved a megajoule of aluminum and (separately) tungsten ions at flow speeds in excess of 2000 km/s, corresponding to ion energies of 0.54 and 3.7 MeV, respectively. For the same kinematics, and pulser operation, the total flow energy would remain a MJ and the average ion energy for a DT plasma (at 2.5 AMU) would be 50 keV. These values suggest the possibility of "isothermal" compression by liner implosion to interesting particle densities at fusion-level temperatures. Based on the Open Fire experiments, the initial plasma density would be 10^{17} cm^{-3} in a volume of 1500 cm^3 at a temperature of 16 keV (after sharing energy with electrons). A 3-D liner implosion of about 5 MJ could isothermally compress this plasma to 10^{20} cm^{-3}, with a dwell time at high density of about a microsecond, providing an nτ-product of 10^{14} s/cm^3. Such experiments, in which heat-loss actually helps, are within range of present systems, e.g., Shiva Star and Atlas.

[1]P.J. Turchi, et al, "Generation of High Energy X-Radiation Using a Plasma Flow Switch," JAP 69 (4), 1999.

P.J. Turchi
Los Alamos National Laboratory

Date submitted: 25 Jul 2005 Electronic form version 1.4