PLASMA PROPERTIES OF RADIAL FOIL EXPLOSIONS ON THE CORNELL BEAM RESEARCH ACCELERATOR*

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High energy density (HED) plasmas, produced by diverse techniques such as lasers or pulsed power generators, can help scientists in understanding extreme states of matter as well as astrophysical phenomena. Radial foil configurations are novel experiements which can yield plasma pressures on the order of 0.5 Mbar on a 1MA, 100 ns current rise time generator such as the COrnel Beam Research Accelerator (COBRA). In this experimental set-up, a thin metallic foil stretched on a circular anode connects to a very small "pin" cathode (1mm in diameter). Radial currents run through the foil then down the pin cathode, thereby generating an axi-symmetric toroidal magnetic field. These currents interact with the B field and the resulting JxB force lifts the foil upward. Very rapidly the plasma turns into a bubble shaped cavity, which expands swiftly (v~200-300 km/s), until instabilities destroy the axial symmetry, bursting the bubble open. As the cavity moves away from the cathode a dense central plasma column with electron densities above 10^{20} cm^{-3} forms. The background plasma created by current ablation focuses on the geometrical axis, forming a jet moving at a speed of 100 km/s. Its electron density is larger than 10^{19} cm^{-3}. This jet is collimated by magnetic fields, which confines its mass during a large portion of the discharge.

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* This research was fully supported by NNSA/DOE Grant # DE-FC52-06NA 00057