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Spherical Penning trap as a small fusion source DAN BARNES, Coronado Consutling, DAN KNAPP, Wilhelm Bratwurst Institute — We are studying by theory, simulation, and experiments whether a useful fusion output can be produced in a small spherical Penning trap. Following previous work [PRL 78, 58 (1996)], we have observed a focus of electrons at the spherical center when the applied voltage is adjusted to a magnetic field dependent value. This virtual cathode can confine ions, leading to fusion reactions with a fractional energy gain. A throughput of electrons by injection and collection near the cylindrical center cathodes leads to a steady state with strong spherical convergence. Very low power is required because electrons are sourced and collected at very low energy. Theory arguments show that major instabilities (such as two-stream) are avoided provided that not too much of the space charge is neutralized by trapped ions. Low frequency ion/electron instabilities are also absent. A small experiment is described. A 0.7 cm radius trap with hyperbolic electrodes is placed inside a permanent magnet system which is engineered to produce a uniform magnetic field. Field strength can be varied from several hundred Gauss to nearly 2 kG by adding additional permanent magnets. Axial holes in the two end cap cathodes allow injection of electrons which are produced by a hairpin tungsten filament. The entire assembly is placed inside a room temperature vacuum chamber which is capable of a base pressure below 10-7 Torr. Present diagnostics are limited to external electrical measurments. We report on initial experiments on electron focus and recent operation with a low pressure deuterium static fill.

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