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Progress Towards a Practical Multicell Positron Trap[1]

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The physics and technology of positron confinement is central to a range of applications at the forefront of antimatter science. Progress in this area has been driven by the development of a suite of novel non-neutral plasma techniques whereby up to 4×10^9 positrons have now been trapped and stored.[2] However the next generation of experiments will require orders of magnitude more positrons. This talk describes techniques to increase storage capacity to $\geq 10^{12}$ using a novel multi-cell trap architecture.[3,4] Plasmas will be stored in separate Penning-Malmberg traps ("cells") arranged in parallel off the magnetic axis to maximize use of the magnetic field volume while minimizing the required confinement voltages. Experiments with electrons in a test structure will be described to explore the basic physics and technology of the multicell concept and to set the design of a 21-cell trap for 10^{12} positrons. Over 50% of a trapped plasma has been injected into an off-axis cell, and hour-long confinement of 2×10^8 particles has been achieved using rotating electric fields. Experiments are under way to identify the limits of the injection process and demonstrate confinement $> 10^{10}$ particles in a single off-axis cell using kilovolt confinement potentials.

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[2]D. W. Fitzakerley et al, *Bull. Am. Phys. Soc.* **58**, 176 (2013).
[3]Danielson, Weber, Surko, *Phys. Plasmas* **13**, 123502 (2006).
[4]Danielson, Hurst, Surko, AIP Conf. Proc. **1521**, 101 (2013).