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5P12 - Cinco: A Compact High-Current Driver for High Energy Density Physics

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Many current high-energy-density physics (HEDP) and material science experiments require a large investment of time and research funds, and often come with a low duty factor. We have developed the Cinco HEDP driver, which is a compact pulsed power generator that can be fired more than four times a day (load limited) and has a footprint of only $2m^2$. Cinco will be capable of providing pressures up to $1Mbar$ on an $8mm$ wide strip-line load, with current-pulse tailoring. Cinco is comprised of sixty bricks connected in parallel with the load. The bricks will be able to be tested individually for performance and reliability prior to installation in the larger structure. Each brick consists of two, 150-nF capacitors (also in parallel), connected in series with a low-inductance multi-channel gas switch. The bricks are then connected to a parallel-plate transmission line, insulated with Mylar, and connected to a small strip-line load for high current densities. Depending on the load construction, a range of peak pressures and pressure profiles can be achieved. When modeled with a $16mm$ long and $8mm$ wide load, and all 60 bricks firing simultaneously, a peak pressure of $1Mbar$ was seen with a rise time of approximately $300ns$. When a flyer plate was used, however, the velocities achieved were comparable to current, two-stage gas guns. Overall, the Cinco meets a need in HED physics for portability, duty factor, cost, and ease of use. Also, with the coupling of x-ray diffraction, we can quantitatively explore material properties under extreme pressures. We will present the design details of the Cinco bricks and the Cinco HEDP driver and preliminary performance data.

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