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Laser triggered solid state pulse charging system utilizing GaAs PCSS technology

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The near simultaneous laser triggering of hundreds to thousands of Photoconductive Semiconductor Switches (PCSSs) is an enabling technology being pursued by both the Department of Energy (DOE) and Department of Defense (DOD) for pulse power (PP) and directed energy (DE) systems. Applications include the development of EMP or HPM phased array sources and large-scale pulsed power systems requiring high energy, low jitter, synchronized trigger pulses for many thousands of spark gaps. Laser triggering of commercially available Gallium Arsenide (GaAs) PCSS provides: electrical isolation, low jitter, fast rise times, long switch lifetime, system scalability and compactness, potentially low cost per trigger channel, and the ability to precisely time the delivery of stored energy to drive various loads.
The development of a compact, low jitter (≤300ps), laser triggered pulse charged (PC) system based on GaAs PCSS technology with the potential to provide several hundred synchronized output pulses is reported on. The flashlamp pumped Q-switched laser driver can operate from single shot to a few Hz. The laser trigger system utilizes optical fiber fanouts to synchronize the delivery of 0.3 mJ of optical radiation centered at 840 nm in 25 ns to nine GaAs PCSS. These GaAs PCSS are connected to 1 nF capacitors pulse charged to a differential voltage of 100 kV in ≤ 10 μs. The laser triggered & GaAs PC system is envisioned to be a direct replacement for high voltage (HV) electrical trigger pulse generators utilized in spark gap switched Marx generators, capacitor banks, and LTDs. The system under development may provide up to one hundred, synchronized, several Joule, 100 kV open circuit trigger signals and yield an order of magnitude improvement in jitter and risetimes in comparison to existing HV electrical trigger pulse generators.

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