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5P50 - A Means of Producing Precisely Delayed High Peak Power Optical Pulses with Low Jitter

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A Means of Producing Precisely Delayed High Peak Power Optical Pulses with Low Jitter

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Abstract. An electronically controlled optical system is being preliminarily designed to generate carriers in two or more photo-conductive semiconductor switches (PCSS) with precisely controlled relative delays. To minimize heating and support high voltages, the PCSS must be triggered with sub-nanosecond high energy optical pulses. A number of means of generating controllable delayed sub-nanosecond optical pulses have been researched, with fiber lasers being pursued to produce these pulses because of their low entry cost, power scalability, and robustness. A commercial fiber laser system consists of a diode seed laser and a doped fiber amplifier. The pulse length and relative timing is set strictly by the diode seed laser. This implies that a low energy system can be developed on low cost fiber coupled diode lasers and the pulse energy can be scaled to relevant magnitude with the addition of a fiber amplifier. The relative delay between the sub-nanosecond optical pulse input into one switch and successive switches requires very low jitter, down to tens of picoseconds. The initial fiber laser design aims to produce precise and adjustable time delayed optical pulses. The optical pulse delay is produced by a fiber coupled seed laser diode, a short pulse laser diode current driver, and a delay module acting as an electronic trigger for the current driver. A survey of means of producing delayed optical pulses will be presented, with a comparison of their relative merits. A more detailed analysis of a delay system based on fiber lasers will also be presented, with designs and analysis for production of short optical pulses and adjustable time delays.

Index Terms—Fiber laser, optical delay, photo-conductive semiconductor switch (PCSS).

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