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Compact Marx Generator to Drive a Low-Impedance MILO

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A low-impedance MILO is being developed at Texas Tech University, and a compact Marx generator was designed to drive it. The target design goals of the Marx are an output voltage greater than 500 kV and an output current greater than 40 kA. Risetime needs to be sub 150 ns and the pulsewidth must be greater than 100 ns. These performance goals were determined from PIC simulation of the MILO such that an RF efficiency (>10%) and RF peak power (> 1 GW) can be achieved.

Tests using smaller 3 and 4 stage Marx generators with the same topology as the final design were used to determine a per-stage inductance of approximately 120 nH. From this derived inductance, multiple configurations were simulated to decide upon the ideal design for the desired performance goals. From these simulations, an 18-stage Marx with 2 capacitors per stage was chosen as the most optimal design, and from simulations into a 12 Ohm load a number of the criteria can be met with this configuration.

The simulated peak voltage and current are 570 kV and 48 kA, respectively, while pulse risetime and pulsewidth are 170 ns and 540 ns, respectively. The designed Marx is being experimentally validated to confirm the findings of the simulation, firing into an approximately 12 Ohm water load to represent the low-impedance MILO that is being designed.

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