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A compact, low cost Marx bank for driving capillary discharge plasmas

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We describe a Compact Marx Bank (CMB) that provides 20 kV, 500A pulses of around 100 ns duration. This is used to drive a gas-filled capillary discharge plasma of density 1018 cm⁻3. This plasma cools at the capillary walls and so forms a positive GRIN waveguide that can guide intense laser pulses over lengths of up to 30 mm. The CMB is triggered with a high speed solid state switch with less than 5 ns voltage jitter. The small size of the CMB (20 cm 25 cm 5 cm) means that it can be placed in the vacuum target chamber, right next to the capillary, avoiding the need to impedance match as there is negligible cable transit time.
Since the electrical energy required per discharge is < 1 J and the shot rate is presently < 1 Hz, it can be powered by a small lead acid battery and floated relative to laboratory earth. The CMB is readily scalable and pulses > 50 kV have been demonstrated for use with longer capillaries. Its small size means that many CMB units can be placed next to each other inside the target chamber to create long waveguides, or for staging plasma accelerators.

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