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Preconditioned wire array Z-pinch driven by a double-pulse current generator

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Recently, the concept of the preconditioned wire array Z-pinch was proposed in which the ablation phase was suppressed and the implosion involved all mass of the array. On MAGPIE facility, this was achieved for aluminum wire array by the employing a specially designed two stage wire array, which allowed the generation of a short prepulse current through the wires of the top imploding array, sufficient to volumetrically vaporize all mass of the wire, instead of the core-corona structures. In order to fulfill the preconditioned wire array Z pinch more flexibly, a double-pulsed current generator "Qin-1" facility has been setup, which can produce a 10 kA prepulse current and then a 800 kA main current. The output current of the prepulse current driver to a matched resistive load ($5\ \Omega$) has a peak value of 10 kA, a rise time of 30-50 ns, and a pulse width of 50-80 ns. The main current driver is composed by 42 capacitor-switch bricks. Each brick is composed of two 90 nF low inductance capacitors, a multigap gas switch, and electrical buses connections. The output current to a short load is 0.8 MA, 170 ns under a charging voltage of ± 50 kV. Since the prepulse current driver and the main current driver can be triggered individually, the time interval between the prepulse current and the main current is adjustable. Completely vaporization of a tungsten, aluminum, or silver wire array is achieved by preheating the wire array using the prepulse current (10 kA, 50 ns) on "Qin-1" facility, and greatly suppression of the significant asymmetrical structures, including the core-corona structure, the precursor plasma, the Magneto-Rayleigh-Taylor (MRT) instability, and etc., are observed under the main current (0.8 MA, 170 ns).

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