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Solid-State Pulsed Power System with GaAs-PCSS for Dielectric Wall Accelerator

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Benefiting from solid-state pulsed power system with GaAs-PCSS, dielectric wall accelerator (DWA) as a new kind of high acceleration gradient accelerator has a compact construction that makes it quite suitable for some certain applications, such as proton tumor treatment and industrial inspection. The solid-state pulsed power system is made up of several groups of pulsed power units. Each group contains 2 to 4 units, and each unit is set up as a 2-stage Blumlein line. It is constituted by GaAs-PCSS (Photoconductive Semiconductor Switch) and plate pulse forming lines, which are made of high-performance dielectric ceramic. The GaAs PCSS triggered by a high power laser diode driver works in nonlinear mode and its bias voltage and conduction current can be up to 20 kV and 800 A respectively. In the experiments, the 2-BL unit can provide a 34 kV, 10 ns pulse. Several groups have been used to load accelerating tubes at different intervals so as to accelerate the proton beams which are just passing through. Until now, the solid-state pulsed power system has performed well and a system with 6 groups (14 units in total) can accelerate proton from 40 keV (after the kicker) to 460 keV with 80.5 mA beam intensity.

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