Pulsed power technology for particle beam fusion

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The light ion and electron beam approaches to inertial confinement fusion require the production of 10^{13} to 10^{14} watt and 10^{6} to 10^{7} joule electromagnetic pulses. For berakeven experiments, the power must be transported to a particle beam diode that is between 20 cm and 100 cm from the target. The accelerator technology developed in the particle beam fusion program is capable of fulfilling these requirements.

The key elements of this technology and the principle function of each is summarized as follows: the reliable, low inductance, Marx generators provide the primary energy store; the water dielectric transfer capacitors reduce the charge time of the pulse forming lines to the value required for water dielectric switches synchronize all the modules; the high energy density, pulse forming lines provide the 40 ns duration power pulse; the self-breaking, water-dielectric, multi-channel switches produce the fast risetime of the output pulse; the pulse conditioners transform the voltage to that required for efficient, magnetic insulation; the six meter long, self-magnetically-insulated transmission lines transport the power to within one meter of the target; and the output convolute makes the transition to the particle beam diode. The principles and limitations of each element will be persented.

用于粒子束聚变研究的脉冲能源技术

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用来探索惯性约束聚变的轻离子束和电子束，其电磁脉冲要达到 10^{13}–10^{14} 瓦和 10^{6}–10^{7} 焦耳。对于进行得失相当实验而言，功率要输送到离靶 20 厘米– 100 厘米的一个粒子束二极管上。在粒子束聚变规划中发展起来的加速器技术能够满足这些要求。

这种技术的关键元件和每种元件的主要功能简述如下：可靠、电感小的马克思发生器用来储存初始能量；水介质传输电容器把脉冲成形线路的充电时间降低到水介质开关所需的值；3 兆伏、抖动小的触发气体开关用来使所有的单元同步工作；高能量密度的脉冲成形线路提供 40 毫微秒宽的功率脉冲；自击穿、水介质、多通道开关产生快上升时间的输出脉冲；脉冲调节器把电压值变换成有效的磁绝缘所要求的值；6 米长的自磁绝缘传输线路把功率输送到离靶 1 米以内的地方；输出绕组把功率加到粒子束二极管上。文中还给出每种元件的工作原理和使用限制。