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A study on the pattern waveform high-voltage power supply for the rapid cycling induction synchrotron

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The application of a 10 Hz repetitive induction synchrotron (IS) to the next generation of heavy ion therapy drivers is under investigation*. The IS is characterized by the use of a pulse voltage to accelerate the beam, but until now, due to technical limitations, the magnitude of the pulse voltage could not be perfectly matched to the acceleration conditions. Instead, a pulse density modulation method has been adopted. However, this method inevitably induces synchro-beta coupling, which increases beam emittance. To overcome this problem, we develop a pattern-voltage dc power supply in which the output voltage waveform has a sinusoidal half-wave shape that matches the acceleration conditions. First, a mini-model was fabricated, and comparative experiments were conducted with three different circuit schemes: (A) a bipolar-controlled full-bridge circuit, (B) a unipolar-controlled full-bridge circuit, and (C) a series connected half-bridge circuit. This paper describes the results of these tests and issues for future study.

Footnotes

- Leo Kwee Wah et al., Phys. Rev. Accel. and Beams 19, 042802 (2016). ** K. Takayama et al., Phys. Rev. Accelerators and Beams 24, 011601 (2021).

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