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CEPC injection delay-line kicker magnet R&D

In W and Z energy modes, the CEPC collider rings can adopt off-axis injection to achieve beam accumulation. In order to meet the injection requirements of both modes, the off-axis injection kicker magnet system of the collider rings must be a trapezoidal wave pulse discharge system with the rise time and fall time less than 200ns, the amplitude and width of the trapezoidal wave pulse can be adjustable, and the adjustment range of bottom width is 440-2420ns.
The delay-line kicker magnet can achieve better impedance matching and generate trapezoidal pulse magnetic field to meet the requirements. On this basis, two schemes are designed: a delay-line dipole kicker magnet for pulsed local bump injection scheme and a delay-line nonlinear kicker (DNLK) magnet for NLK injection scheme. The simulation results show that the total rise time (10%-90%) of the delay-line dipole kicker magnet system is 193 ns, the fall time (90%-10%) is 191 ns, the field uniformity in the good field region is better than ±0.2%, the rise and fall time of the delay-line nonlinear kicker magnet system is 146ns, all of which meet the design requirements. A performance prototype of DNLK was designed and tested. The experimental results show that the linear impedance is 10Ω, the common mode impedance is 5Ω, the rise and fall time is 160ns, the pulse amplitude and width are adjustable, and the nonlinear field distribution is consistent with the simulation results, all of which basically meet the design requirements.

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