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Development of a new type adjustable strength permanent magnet quadrupole

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An integrated concept is presented to design a permanent quadrupole magnet (PQM) using tunning modules simultaneously for varying magnetic field gradient. It is anticipated that this design will be utilized for Hefei Advanced Light Facility (HALF) in the future. This design leverages symmetry to achieve both a broad range of magnetic field gradient tunning and a narrow range of precise magnetic field gradient tunning, and produce desired high-quality quadrupole magnetic fields. The PQM primarily achieve magnetic field gradient tunning by modifying the size and position of the tunning modules. The tunning of a wide spectrum of magnetic field gradient is mainly achieved by altering the excitation direction of permanent quadrupole magnets within the tunning module. The precise manipulation of small-scale magnetic field gradient is mainly achieved by manipulating the tunning-tube to modify the excitation effect exerted by the tunning module on the central magnetic field. In light of the aforementioned principles, we propose a design for a quadrupole magnet with a magnetic field gradient approximating 70T/m and magnetic gradient tunning range attain 40% in an aperture radius of 14mm.

Footnotes

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