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Development of Combined function Dipole-Quadrupole PMQs Magnets for NSLSII-Upgrade

Wednesday 13 August 2025 16:00 (2 hours)

This paper focuses on the R&D performed for the development of permanent magnets-based dipoles-quadrupoles combined function magnets (PMQs) for the future NSLSII upgrade "complex bend"lattice (CB). This new lattice uses PMQs that provide both bending (dipole) and strong focusing (quadrupole) magnetic field on the electron beam. The permanent magnet (PM) technology is suitable for the high magnetic field strengths (0.5 T, 130 T/m) required for such combine function magnets. PM technology leads to a compact magnet design that is essential in realizing the complex bend lattice concept, as well as a passive magnet solution which does not require electrical power supply reducing power consumption by ˜ 80% (from 1.7 MW to 0.3 MW for NSLS-II). Two PMQs magnets designs are under consideration: A hybrid design that use both PM and soft iron poles, and Halbach type that is a pure PM design. Both PMQs designs present challenges in achieving the specified magnetic field quality due to their higher sensitivity to errors (mechanical tolerances and PM properties). This paper presents cost-effective designs and prototypes results for hybrid and Halbach PMQs, addressing various technical challenges while meeting the field requirements of the complex bend lattice for the NSLS-II upgrade.

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Footnotes

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