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Design of a Short Period Permanent Magnet Helical Undulator

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The design of helical permanent magnet undulator with a period length of 24 mm for the production of circularly and linearly polarized radiation will be discussed. The helical permanent magnet undulator consists of four pairs of helically shaped Vanadium Permendur poles located between Neodymium Iron Boron magnet blocks. This magnet arrangement is expected to produce helical fields in the cylindrical gap along the longitudinal axis. The helical fields were calculated using the 3-D OPERA computer code. The helical undulator produces in phase vertical and horizontal peak fields of 0.57 T for a 24 mm period length within a bore diameter of 10 mm. The sizes and location of end poles were optimized for optimum control of the first and second field integral. Furthermore, the on-axis independent horizontal or independent vertical magnetic fields can be generated by shifting the relative position of diagonal pairs of helical magnet arrays in this device. It leads to the generation of circularly and linearly polarized radiation in undulator. The gap width and the phase shifter of the undulator can be controlled by mechanical changes to adjusting field strength and for the purpose of tuning the helical and linear photon energy. This work describes the magnetic field simulations and mechanical design of the short period helical permanent magnet undulator.

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