Docket #: S24-091

Segmented Core Undulator Magnet

Undulator magnet cores are essential for advanced applications such as synchrotron radiation sources, advanced chip manufacturing, and fusion technology. SLAC researchers have a new manufacturing approach that achieves greater precision at significantly lower costs.

Fabricating long undulator magnet cores has traditionally been challenging due to the difficulty in meeting precise mechanical and alignment tolerances, especially for lengths exceeding 1 meter. The new designs propose machining shorter, half-period segments that are stacked, aligned, and clamped to create longer cores.

In response to growing demand driven by VUV lithography for advanced chip manufacturing, several companies and research laboratories worldwide are increasing the production of superconducting magnets, including undulators. This low-cost manufacturing approach with enhanced precision holds tremendous potential for both research and commercial applications.

Figure Description: Design of an undulator magnet core. Superconducting wires are wrapped around two iron cores. The winding and current are reversed every one-half period, so the magnetic field in the gap alternates sinusoidally every period.(source: inventor)

Stage of Development: Prototype; a mechanical prototype has been fabricated, assembled, and mounted on Coordinate Measuring Machine (CMM) to confirm the mechanical alignment tolerances.

Applications

- EUV lithography
- Synchrotron radiation sources
- Free Electron Lasers

Advantages

- Low-cost
- Enhanced Precision
- Easier to manufacture

Publications

- Superconducting Undulators (SCU) R&D for World Leading X-ray FEL Capabilities
- Proceedings 2024 Accelerator and Detector Research Principal Investigators' Meeting, Sponsored by the U.S. Department of Energy Office of Basic Energy Sciences, April 16-19, 2024
- SCU Development at the LCLS for Future FELs
- 67th ICFA Advanced Beam Dynamics Workshop on Future Light Sources (FLS2023)

Patents

- Published Application: WO2026043924

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