Contribution ID: **4** Type: **Poster**

Modeling a Cosine-Theta Dipole Magnet with Flat-Shaped Superconducting Coils Using the Constant Perimeter Approach

Thursday, November 14, 2024 1:00 PM (1h 30m)

The construction of magnets using High-Temperature Superconductors (HTS), such as REBCO, requires a specialized winding process due to their flat geometry. The "paper folding" method is implemented to address this issue, maintaining structural integrity by controlling the upper and lower perimeters of the winding magnet coil and preventing critical stress. A custom-made VPython code is employed to determine the optimal folding geometry. Initial conditions set the locations and angles of the two wings of the flat-shaped coil relative to the horizontal plane.

Superconducting magnets can generate stronger magnetic fields than their non-superconducting counterparts, offering significant advantages in applications such as compact particle accelerators and beam transport lines by reducing their sizes. Current designs of superconducting dipoles, particularly in the form of saddle coils, are based on winding around cylindrical tubes, but they often do not account for the twisting strain, which can be problematic for HTS magnets. In this work, we demonstrate a mitigation method for this strain issue.

We present recent progress in modeling a superconducting saddle coil, showcasing how to achieve optimal magnetic fields while maintaining strain within safe limits. This work extends beyond geometric modeling of magnet shapes to include the optimization of uniform magnetic fields inside a beampipe, ensuring effective strain compensation.

Paper submission Plan

Best Presentation

Yes

Contribution track

ICABU WG1. Accelerator Systems

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Session Classification: ICABU Poster Session

Track Classification: ICABU: ICABU WG1. Accelerator Systems