Superconductivity for Sustainable Energy Systems and Particle Accelerators

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Enhancing Sustainability in Large-Scale Accelerators: Revamping Beam Lines with Superferric Magnets

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Accelerator facilities worldwide face a critical challenge in consuming vast amounts of energy to power resistive magnets, particularly in medium- and high-energy particle beamlines. In response to this challenge, our research focuses on the development of superconducting magnet designs as sustainable alternatives to high power comsumption resistive magnets, already in operation. Specifically, we explore the potential of High-Temperature Superconductor (HTS) coils made from ReBCO (Rare Earth Barium Copper Oxide) and MgB2-based cables. The University of Milan and INFN-Milano LASA lab collaborate on this endeavor with a company ASG (Genoa-IT), optimizing magnet designs to accommodate the strain-sensitive behavior of MgB2 and exploit the capabilities of HTS conductors. To test this concept, we have redesigned two resistive magnets in operation at CNAO and at PSI, incorporating MgB2 coils working at temperatures between 10 and 20 K. Preliminary results indicate significant reductions in energy consumption and operating costs, making an upgrade based on revamping the existing resistive magnets with superconducting coils a promising eco-friendly solution for large-scale research facilities.

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