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Alternative Superconducting Magnets: Energy Saving Solutions for Beam Line Magnets

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Large accelerator facilities have a considerable energy consumption largely due to the numerous resistive magnets used in the medium- and high-energy beamlines. Considering the duty cycle of the machine and the cost of energy, new designs based on superconducting magnets have become increasingly attractive as possible alternatives to the use of energy-intensive resistive solutions. High Temperatures Superconductor coils, made in REBCO (rare earth copper oxide) or MgB₂ conductors, can sustain the losses of the ramped magnets thanks to their high energy margin due to the large critical temperature. The research team of University of Milan and INFN-Milano (LASA) is currently developing superconducting magnet designs optimized for replacing the resistive coil of energy-intensive magnet and cope with the strain sensitive behaviour of the HTS and MgB₂ material. We will show examples taken from magnets installed in research facilities like CNAO and PSI upgraded to superconducting configurations using conduction cooling solutions at 10-20 K of operating temperature improving the sustainability of such research infrastructures and maximizing the energy saving factor.

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