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Energy saving magnets for beam lines

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Beam lines magnets for high rigidity particles can have a large power dissipation. In presence of a high duty cycle, this translates in a considerable amount of energy waste. The call for sustainability of large research infrastructures, like particle accelerator centers, and also the recent increase of the cost of energy, requires to take measures to reduce the energy consumption, even if at cost of moderate investment. A project called ESABLIM (Energy SAving Beam LIne Magnets) has been launched at the LASA lab of University and INFN Milano, aimed at revamping existing normal-conducting magnets for beam lines in order to cut by a factor 10 to 20 the peak power and reducing the energy consumption by factor 3 to 5. The idea is to re-use the iron yoke-pole assembly of a magnet and replace the water cooled coils with new superconducting coils cooled at 10-20 K by means of a cryocooler. We envisage use of MgB2. For its moderate cost. However, we are also considering HTS (REBCO) conductor. We present the first advanced design for revamping of a large bending dipole in a hadron therapy center (CNAO), and the conceptual design for magnets in a nuclear physics laboratory and we try to define the domain where this transformation of normal-conducting into super-ferric magnets can be technically and economically advantageous.

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