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Wed-Mo-Or11-03: Experimental results of field-error cancellation with HTS-based magnetic screens

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Future circular accelerators for high-energy particle physics are expected to rely on increasingly higher magnetic fields for steering and focusing the particle beams. High temperature superconductors (HTS) are a promising technology for such future accelerator magnets. In particular, superconducting tapes based on rare-earth cuprate compounds (ReBCO) are potentially excellent candidates. Such tapes can withstand magnetic fields up to several tens of Tesla without losing their superconducting state, and achieve a critical temperature of about 90 K. Therefore, high thermal margins can be achieved by operating the tapes at 10 K and below.
While these outstanding magnetic and thermal properties make the use of HTS tapes a very interesting option, magnetic field control and quality are still a concern. Whenever an HTS based magnet operates in dynamic regime, for example during a current ramp, large eddy currents are induced in the superconducting tapes. These eddy currents typically show a decay time that is longer than the duty-cycle of the magnet. The magnetic field error induced by this undesired eddy currents could potentially prevent the use of HTS tapes in applications requiring a tight control over the field quality.
In order to improve the field quality in superconducting magnets, we propose to use dedicated magnetic screens based on the HTS technology. The screens are derived from the concept of persistent current shim coils [1]. To prove the potential of such screens, a dedicated experimental setup for transverse magnetic field configurations has been developed. In this contribution, we describe the setup, the proposed experiments and present the most relevant results in terms of magnetic field errors.

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[1] Van Nugteren, Jeroen. High temperature superconductor accelerator magnets. Diss. Twente U., Enschede, Enschede, 2016.

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