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Fiber-optic diagnostic system for future accelerator magnets

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The next generation high energy physics accelerators will require magnetic fields at ~20 T. HTS coils will be an essential component of future accelerator magnets and several efforts are currently dedicated on designing 20 T HTS- LTS hybrid magnets. Among the existing challenges, there is the lack of a robust quench detection system for hybrid magnet technology. Another big challenge is represented by the high number of training quenches required by Nb3Sn magnets to reach performance level..
In this paper, we propose the use of fiber optics sensors for diagnostic and quench detection in future accelerator superconducting magnets. Discrete and distributed fiber optic sensors have demonstrated to be a promising tool. The goal is to instrument hundreds of accelerator superconducting magnets and to move beyond the proof-of-concept level. Significant developments are still needed. Here, we are going to present the most recent results and discuss the most urgent technical developments in order to make those sensors a robust and reliable diagnostic tool for accelerator superconducting magnets over the next 10 year.
We foresee that discrete fiber sensors will be a stable diagnostic probe for superconducting magnets over the next 3 to 5 years. More R&D work will be necessary for distributed fibers. The most urgent needs are the increase of sample rate and sensitivity. Close collaboration with vendors will be necessary to improve mechanical properties and fabrication processes to produce hundreds of meters of fiber and instrument many accelerator superconducting magnets. Those R&D efforts will last up to 10 years with a founding level that spans between 5-10 M$.

In-person or Virtual?

Virtual

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