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An Open Lab for the Development of Technical Superconductors

Abstract

Superconductivity is a core technology that has fueled the progress in high-energy physics (HEP) accelerators, from the Tevatron of the early 1980's to the Large Hadron Collider of the late 2010's [1,2,3,4]. The engineering knowledge of superconducting materials in the form of composite wires, tapes, or thin layers finds application in high-field accelerator magnets [5], very large detectors magnets [6] and high-gradient/low-loss RF cavities [7]. The progress witnessed in the past years has been remarkable. Comparable progress will be required to meet a number of HEP challenges in the close future, and mainly:

- Realize ultimate performance in Nb₃Sn, as it has been specified for the realization of the main magnets of a Future Circular Collider in a new (FCC) or existing (HE-LHC) tunnel [8];
- Demonstrate the potential of HTS materials to surpass LTS accelerator magnet technology, providing efficient very-high-field or high operating margin options for specific locations in existing and future colliders, and eventually to extend the energy reach of circular synchrotrons [9].

This success was possible so far thanks to a virtuous circle of applied superconductivity, encompassing fundamental science, applied research and industrial production. Due to several factors, we observe that this virtuous circle is losing its effectiveness. This is perceived as a serious threat to the future of a robust applied superconductivity program for HEP and is the main justification for this proposal. In short, we propose to secure this technology by founding an Open Laboratory for Applied Superconductivity that will work as a bridge between academia and industry. This proposal is driven by an identified need, and at this stage the implementation is not localized in a specific institute.

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