

Project Summary/Abstract

Company Name & Address: Particle Beam Lasers, Inc.
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Project Title: A hybrid HTS/LTS Superconductor Design for High-Field Accelerator Magnets

Topic No: 35 High Field Superconductors and Superconducting Magnet Technology for High Energy Physics Colliders

Subtopic: (b) Superconducting Magnet Technology

Abstract

The next generation of particle accelerators, including a proposed LHC upgrade, will move to higher energy and luminosity in order to continue the exploration beyond the limits of the present LHC. This will require new technology—in particular, higher field (20T or more) dipoles as well as better interaction-region quadrupoles to focus the beams at the collision points. This proposal seeks to address this need by applying high-temperature-superconductors (HTS) in a hybrid design with the more-conventional low-temperature-superconductors (LTS) Nb₃Sn and NbTi. We will explore designs with Bi-2212 Rutherford cable and second-generation YBCO tape. A hybrid dipole magnet will be designed, based on the parameters of one application—the proposed energy upgrade to the LHC. This Phase I will build on an earlier Phase I SBIR which showed that YBCO tape could be wound on the pole of a dipole magnet without serious degradation. The experimental part of the present Phase I will develop techniques to wind the midplane turns of a YBCO tape dipole, and the coil will be tested at 77 K in liquid nitrogen to insure that there is no large degradation. Hybrid dipole based on the design developed in Phase I will be built and tested in Phase II.

Commercial Applications and Other Benefits: Since the cost of HTS superconductors likely will remain high, it is important to develop hybrid HTS/LTS designs, in order to make these magnets commercially attractive. Commercial spin-offs in the areas of medical accelerators and security screening can follow the development of this technology, just as the development of MRI magnets followed LTS magnet technology developed for earlier HEP accelerator magnets. The knowledge gained from the conductor bend tests and coil performance tests will provide valuable feedback to the conductor manufacturers in their efforts to improve these conductors to better meet the needs of the magnet community.

Key words: Accelerator magnets, High temperature superconductors, YBCO, Bi-2212

Summary for Members of Congress: To build upon the discovery of the Higgs boson, a “Higgs factory” based on an LHC upgrade or a muon collider requires higher field magnets available only via high temperature superconductors (HTS). This Phase I project is to explore the feasibility of using HTS superconductor in a hybrid HTS/LTS magnet to meet these high field magnet requirements.