TOAB005 Currents in, Forces on and Deformations/ Displacements of the LHC Beam Screen Expected during a Magnet Quench

Christian Rathjen, Fritz Caspers, Stephan Russenschuck, Andrzej Siemko (CERN)

Due to the asymmetry of the LHC dipoles, the magnetic field integral calculated from the centre of the aperture to the outside of the cold mass does not vanish. During a magnet quench this asymmetry generates an electromotive force and thus a current with a resultant radial force on the beam screen. This induced force could be observed indirectly by measuring the deformation of the beam screen cross-section during a quench using a precision displacement transducer. The transducer, based on optical gratings, which has been developed specially to study the beam screen deformation in a cryogenic environment and inside a high magnetic field will be described. The results of these measurements are compared to calculations taking into account the variation of the field integral and the impedance along the current path as derived from the measurements. An estimation of the forces exerted on the cold bore by the beam screen and of the actual current induced in the beam screen will be given.

TOAB006 Fermilab Electron Cooling Project: Field Measurements in the Cooling Section Solenoid

Alexander Shemyakin, Curtis Crawford, Elliott McCrory, Sergei Nagaitsev (Fermi National Accelerator Laboratory), Valentin Bocharov, Alexander Bubley, Vasily Parkhomchuk, Vitaly Tupikov (Budker Institute of Nuclear Physics)

To provide the maximum possible cooling rate, the cooling section has to be immersed into a high-quality longitudinal magnetic field. Namely, the solenoidal field of 50- 150 G should have an integral of the transverse component below 1 G*cm over the whole 20 m cooling section. The transverse components are measured by a dedicated compass-based sensor, which has been designed and manufactured at Budker INP, Novosibirsk. The paper will describe results of the field measurements performed on the first part of the cooling section solenoid as well as the design and the calibration procedure of the sensor.

Session TOAB: Magnets (2 of 2)
Grand Ballroom (Session B) at 10:40
Session Chairs: G. William Foster (FNAL) and Alan Jackson (LBNL)

TOAB007 Advanced Magnet R&D for Future Colliders (Invited)

GianLuca Sabbi (Lawrence Berkeley National Laboratory)

High-energy colliders complementing and expanding the physics reach of LHC are presently under study in the United States, Europe and Japan. The magnet system is a major cost driver for hadron colliders at the energy frontier, and a critical component for the successful operation of muon colliders. Under most scenarios, the magnet design as well as the vacuum and cryogenic systems are further complicated by high radiation loads. Significant advances in superconducting magnet technology are required for these machines. Conventional designs based on NbTi conductor wound in shell-type coils are deemed inadequate and vigorous R&D programs are underway to take advantage of new developments in superconducting materials, achieve higher efficiency and simplify fabrication while preserving accelerator-class field quality. A review of recent progress in magnet technology for future colliders is presented, with emphasis on the most innovative design concepts and fabrication techniques.

TOAB008 Superconducting Materials and Applications (High and Low Temperature) (Invited)

Lance Cooley (University of Wisconsin)

Particle accelerators demand the ultimate performance from superconducting materials, particularly the critical current density Jc. In practice, 1-10% of the theoretical Jc limit is realized due to the limitations of flux pinning. Steady progress has been made in understanding and improving the flux pinning in practical superconductors for accelerator magnets, and new performance records have been set in the past year. Jc in Nb-Ti strands have for the first time exceeded 4000 A/mm^2 at 5 T field and 4.2 K temperature, due to an increase of titanium precipitate (the flux pinning sites) volume fraction for allowing higher iron content in alloy specifications. Nb_3Sn strands with Jc exceeding 2000 A/mm^2 at 12 T, 4.2 K can now be manufactured by a variety of means, and R&D efforts to scale up to ton quantities are underway. Recent experiments suggest that strong flux pinning is already formed at very early stages of the reaction heat treatment, and new breakthroughs may come by understanding how to produce chemical homogeneity of the Nb_3Sn layer within a short reaction time. For very high field magnets, recent developments in Nb_3Al and Bi-2212 strands have resulted in new insert magnets for 1 GHz NMR projects. Besides these performance issues, I will also address other considerations that may affect the conductor cost.

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TOAB009 Fabrication and Test Results of a High Field, Nb_3Sn Superconducting Racetrack Dipole Magnet

Stephen Gourlay, Bob Benjegerdes, Paul Bish, Doyle Byford, Shlomo Caspi, Dan Dietderich, Ray Hafalia, Roy Hannaford, Hugh Higley, Alan Jackson, Alan Lietzke, Nate Liggins, Alfred McInturff, Jim O'Neill, Evan Palmerston, Gianluca Sabbi, Ron Scanlan, Jim Swanson (Lawrence Berkeley National Laboratory)

A program based on exploring the benefits of racetrack coil designs for utilization of brittle superconductors to achieve high fields is underway at LBNL. A 1 meter, three-layer, racetrack dipole magnet, utilizing state-of-the-art Nb3Sn superconductor, has been built and tested. Relevant features of the wind-and-react fabrication process and final assembly of the magnet will be presented, along with the latest test results of the 14 Tesla proof-of-principle coil configuration.

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