IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 57, Oct 2024

Status and Perspectives in High Field Superconducting Magnets for Particle Accelerators

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***Abstract*–Superconducting magnets have been an enabling technology for particle accelerators for more than 40 years. An introduction on the specific challenges of high field accelerator dipoles with respect to other devices, such as solenoids or detector magnets, will be provided followed by a brief historical overview of the development of Nb-Ti magnets for particle colliders, up to the 8 T dipole fields achieved in the LHC at 1.9 K. Nb_3Sn was considered as an option for LHC; we will recall the development of Nb_3Sn dipole short models in the 10-14 T range in the past 35 years. The focus will then shift to the present status of Nb_3Sn technology used in the quadrupoles to be installed at CERN in the High Luminosity LHC at the end of this decade, with 11.5 T operational peak field and lengths up to 7.5 m. To continue, the developments of Nb_3Sn dipoles for future colliders aiming at an operational field of the order of 14 T will be discussed. High Temperature Superconductors are used as current leads in the LHC and are planned for the HL-LHC: we will give an outlook on the opportunities and challenges of making dipole magnets using HTS, to achieve fields of the order of 20 T.**

***Keywords (Index Terms)*–Accelerator magnets, superconducting dipoles and quadrupoles for colliders, magnet design and analysis**

IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 57, Oct 2024. Plenary presentation given at ASC 2024, Sept 2024, Salt Lake City, Utah, USA.