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Wed-Mo-Po.12-01: A HTS-based Diode for powering superconducting magnets

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The development of superconducting diodes has significant interest for their potential to revolutionize advanced magnetic systems such as magnetic systems powered by a flux-pump. A novel method for producing a passively controlled superconducting diode has been developed. The design is based on high-temperature-superconducting (HTS) conductor technology with the use of a ferro-magnetic yoke. A demonstrator has been built and tested to validate the concept.
In this design we will utilise the relatively low critical field properties of BSCCO-2223 as a switching element. The switching element interact with a magnetic field induced by a ReBCO bias coil wound around a ferromagnetic core. In series of the switching element there is second ReBCO coil wound around the Bias coil called the "primary coil". The primary coil will increase or decrease the field induced by the bias coil and therefore switch the switching element. The diode allows high current (>100 A) to pass for one voltage polarity and prevents the current flow in reversed polarity. This is done with minimal losses, no heating elements, and no active controls.
In this presentation, the design, the associated simulations, and the experimental results obtained with the demonstrator are presented. HTS-based diodes have a variety of potential applications, for example for the powering of superconducting magnets such as when using a flux pump and subsequent persistent operation.
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Authors: DUDAREV, Alexey (CERN); Dr KARIO, Anna Urszula (CERN); CURE, Benoit (CERN); VAN DER WERF, Jasper (CERN); MENTINK, Matthias (CERN)

Presenter: VAN DER WERF, Jasper (CERN)

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