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A 3 T High Temperature Solenoid Design for the IDEA detector project

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Different particle detector design concepts are currently being explored for the Future Circular Collider in the electron-positron option (FCC-ee). Different proposals (CLD and IDEA detectors) for the main experiments have been already selected to be further developed in the FCC international collaboration study, including compact superconducting solenoids up to 2 T of nominal magnetic field based on aluminum-stabilized NbTi Rutherford cables technology. To further optimize the energy resolution of the detector, allocating a new concept of dual readout crystal and fiber calorimeter, a new solenoid design, developed at INFN LASA, featuring a 3 T high temperature superconductor (HTS) winding, is proposed. By using this type of emerging technology and operating at cryogenic temperatures above 20 K, the cryogenic power consumption of modern superconducting solenoids for particle detectors can be drastically reduced, enhancing the accelerator facility's sustainability. The new design based on aluminum-stabilized HTS conductors is presented here and discussed, showing how high-temperature superconductors could become a viable option for particle detectors at collider experiments.

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