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Design of the cryogenic system of the CYCIAE-2000 MeV superconducting magnet

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GeV-class proton beam with an average power of several megawatts have many important applications in particle physics towards the intensity frontier, as well as in the accelerator driven subcritical system, and material science. In 2019, China Institute of Atomic Energy (CIAE) proposed an isochronous FFAG conceptual design with capability of producing 2GeV/6MW CW proton beam. The main magnet of this isochronous FFAG adopts a 10 fold symmetric FDF structure design. And each single focusing magnet or defocusing magnet uses high-temperature superconducting magnet design with varing gradient in a large radial range, operating in the temperature range of 20 K to 30 K to provide both sufficient focusing force and high energy efficiency. In order to ensure the superconducting coils have a uniform temperature distribution as well as to ensure the cryogenic system has a low energy consumption, the helium gas recycling cooling of high temperature superconducting coils is used in superconducting magnet systems. This paper introduces the schematic design of the cryogenic structure for the CIAE-2000 MeV superconducting magnet.

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