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Wed-Af-Po3.17-03 [31]: Mechanical design and analysis of the BabyIAXO magnet cold mass, cryostat and support system

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According to the Primakoff effect, axions and axion-like particles can transform into photons in the presence of a strong magnetic field. To continue the search for these hypothetical particles, a new helioscope called the International Axions Observatory IAXO, and its subscale fully functional demonstrator BabyIAXO, are being designed.
To increase the sensitivity by a factor of a 100 compared to CAST, the experiment needs a stronger magnetic field and in a larger volume. The superconducting magnet of Baby-IAXO features two 10-m long flat racetrack coils, spaced by 0.8 m, operated in a quadrupole configuration and generating an average magnetic field of 2.9 T in the two 700 mm detection bores positioned between the coils.
The cold mass structure, using mainly Al5083, is designed to handle the pre-stress of the coils and the magnetic loads generated with current on. At ultimate current of 12 kA, the repelling force between the coils is 8 MN. Furthermore, the supporting structure has to keep the coils in position as they are in an unstable equilibrium in the plane parallel to the racetracks.
To support the cold mass in the cryostat, an arrangement of rods was chosen to minimize the cryogenic load. There are 4 vertical titanium rods taking the weight of the magnet; and another 4 of permaglas to keep the cold mass centered during cool down. In addition, there are 8 longitudinal permaglas rods whose main purpose is to allow the 25° tilting of the magnet while tracking the sun.
The total mass of the magnet is 22 t comprising a 15 t cold mass and 7 t cryostat. The magnet is installed on an elevated 360° rotating platform further constraining the cryostat design.
In this paper the mechanical design of cold mass, supporting system and cryostat of the BabyIAXO magnet are presented.

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