A high temperature superconducting demonstrator coil for a novel toroidal magnetic spectrometer for an astroparticle physics experiment in space

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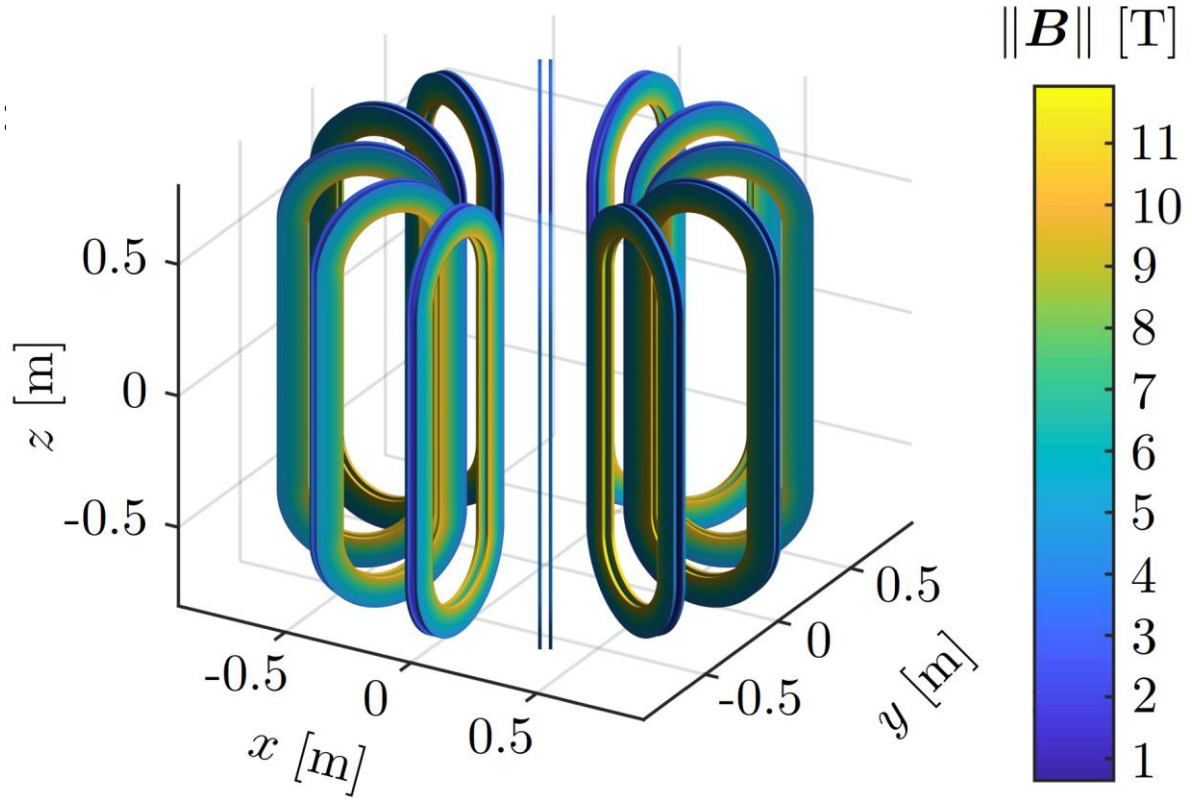
The toroidal magnet system

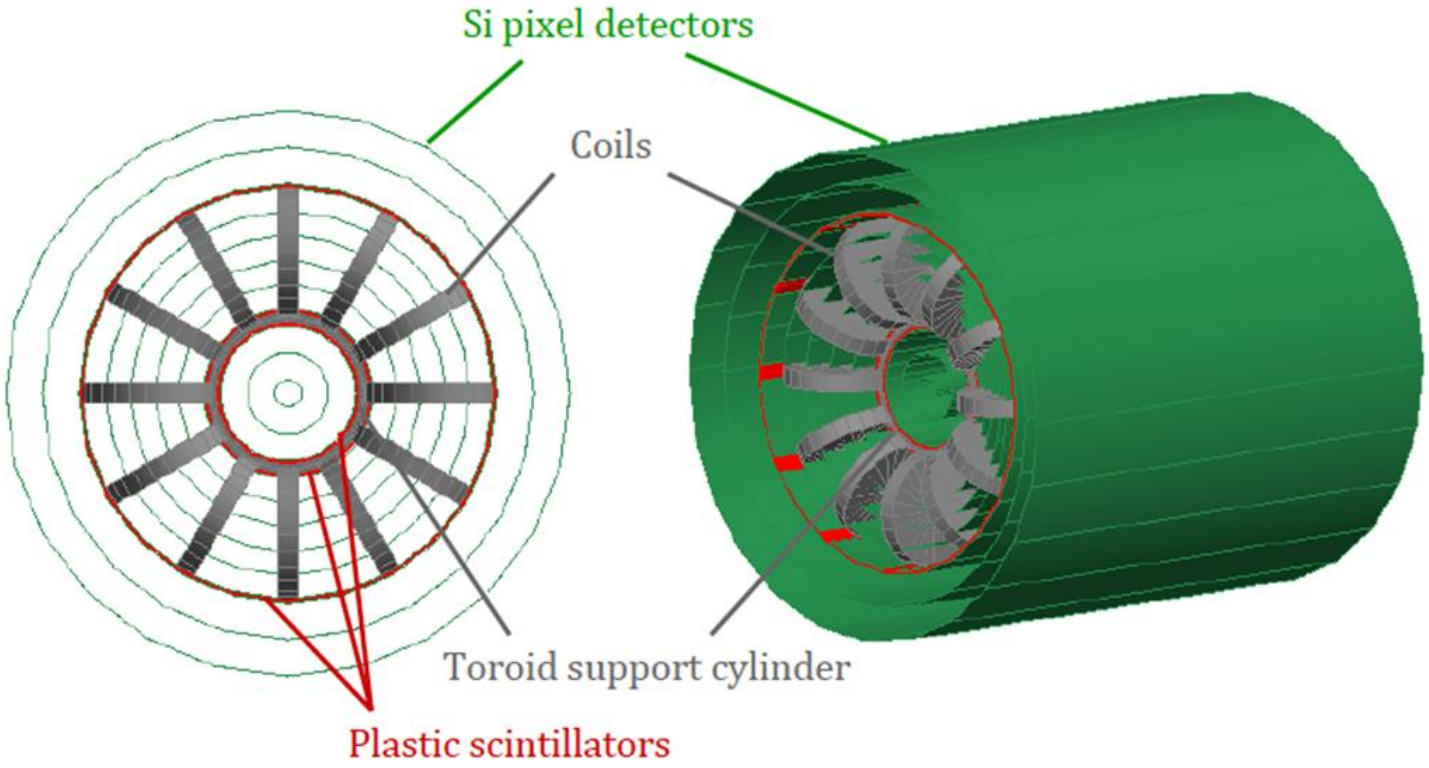
- 12 racetrack-spaced double pancake coils
- Average bending strength of 3 Tm
- Engineering operating current density: 855 A/mm^2
- Operating temperature: 20 K
- Peak field: 11.9 T
- Total HTS tape length: 62 km
- Stored magnetic energy: 39.6 MJ



Detector system

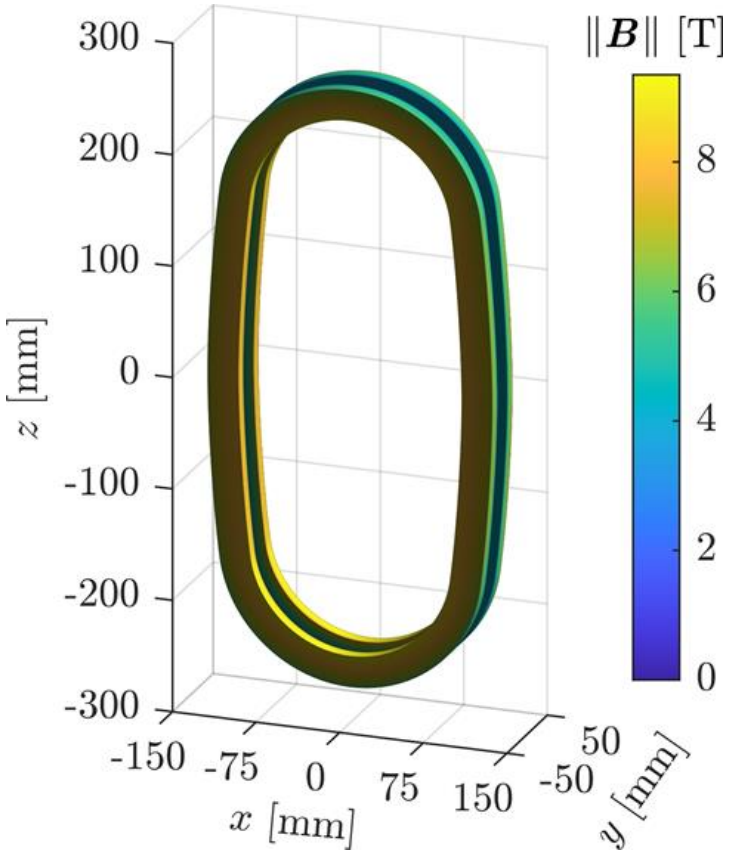
Baseline detector system:

- A tracker, composed of silicon pixel detectors, which measure the charged particle trajectories in the magnetic field
- Plastic scintillators, which provide the trigger to select the desired event topologies.

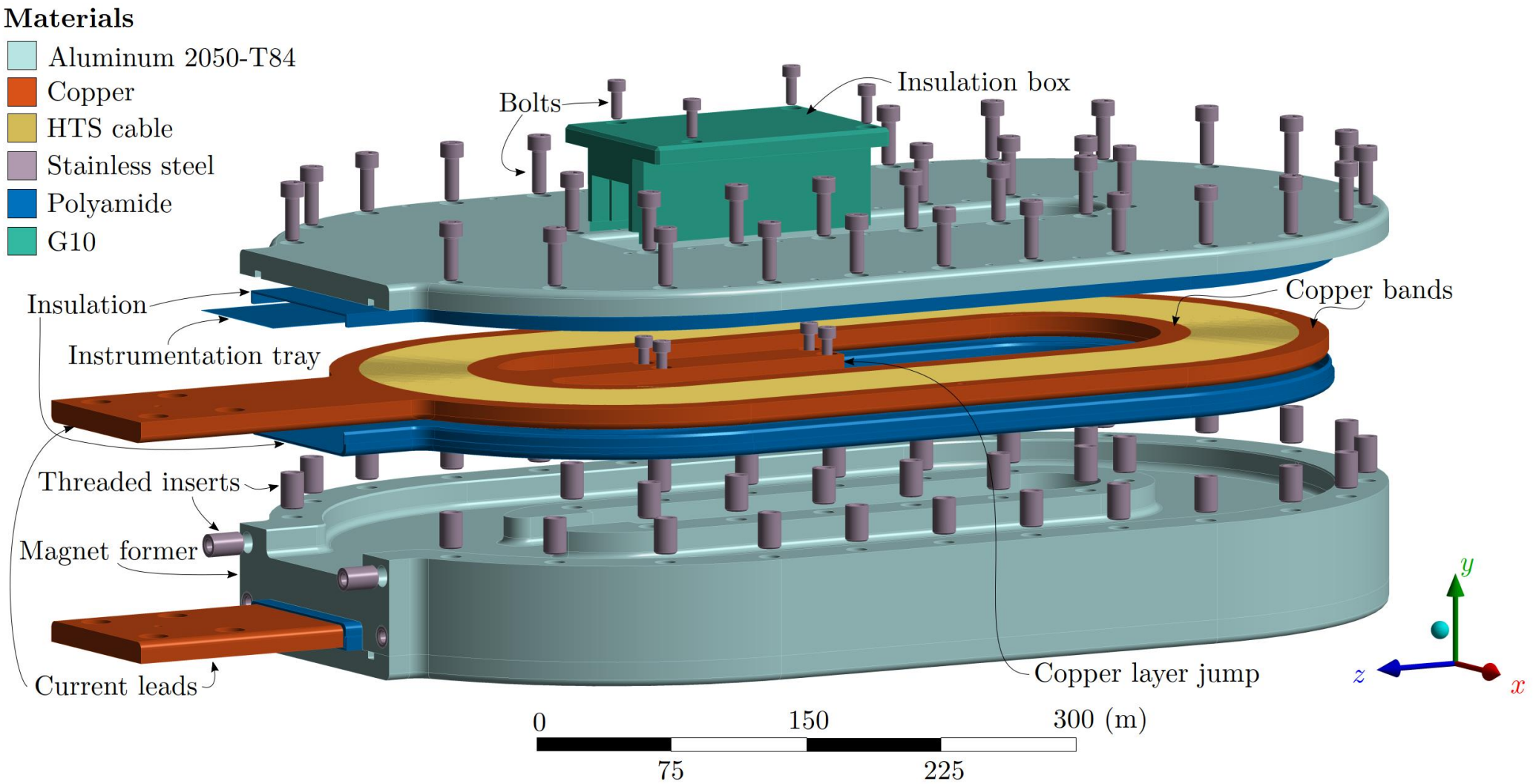


Demonstrator coil design

- Small-scale demonstrator of one coil pack from the toroid
- Two HTS tapes (face-to-face)
- No-insulation winding method
- Maximum calculated engineering operating current density:
  1065 A/mm^2 at 4.2 K, and peak field of 9.3 T
- Total HTS tape length: 750 m
- Maximum stored energy: 143 kJ



Mechanical structure for demonstrator coil



Summary of the HDMS project

Part 1: Conceptual design of a toroidal HTS magnet for a magnetic spectrometer in space

- 12 racetrack-shaped coil packs
- Bending strength: 3 Tm, peak field: 11.9 T
- Lightweight aluminum structure

Part 2: Design and manufacture a demonstrator coil for the toroidal magnet

- Small-scale no-insulation demonstrator coil
- Is being produced at the CERN magnet laboratory