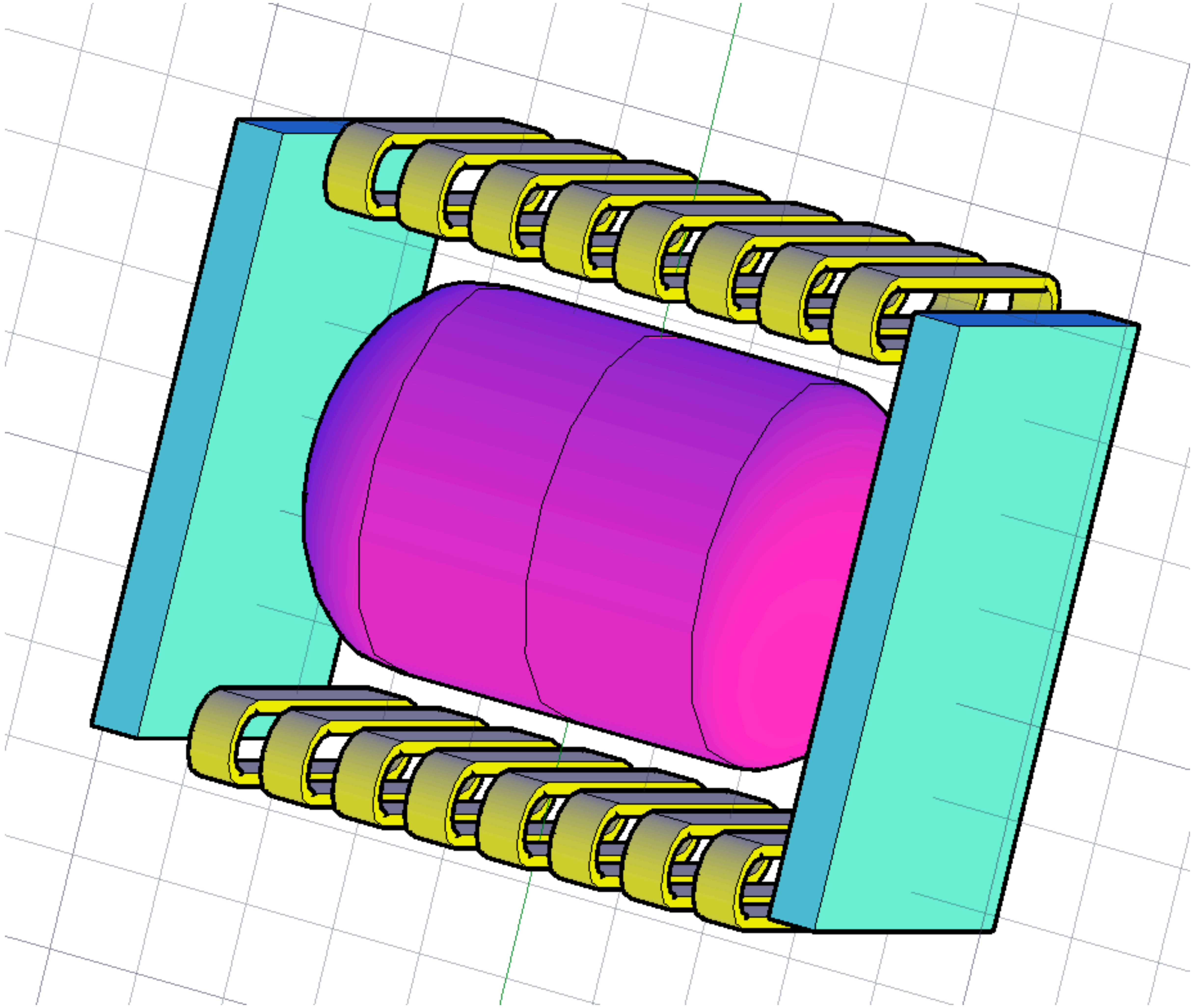
DUNE-ND magnet: some consideration

Andrea Bersani

INFN Sezione di Genova
Istituto Nazionale di Fisica Nucleare

Double dipole tentative design



Double dipole main features

- To cope with the requirement of B collinear with pressure vessel axis:
  - 16 coils (order of 8 m long)
  - two large slabs of iron (definitely to be optimised)

- Ups and downs of the iron slabs
  - they are an order of 500 t problem
  - the can provide independent path load for pressure vessel, calorimeter and coils

- W.r.t. Helmholtz coil design:
  - shorter in beam direction
  - taller
  - no material along beam line (but there is the calorimeter, isn't it?)

Concerns about the design

- These are valid for any design I have seen

- Space optimisation
- Integration with the detectors
- Space available in the hall
- Stray field

About the calo

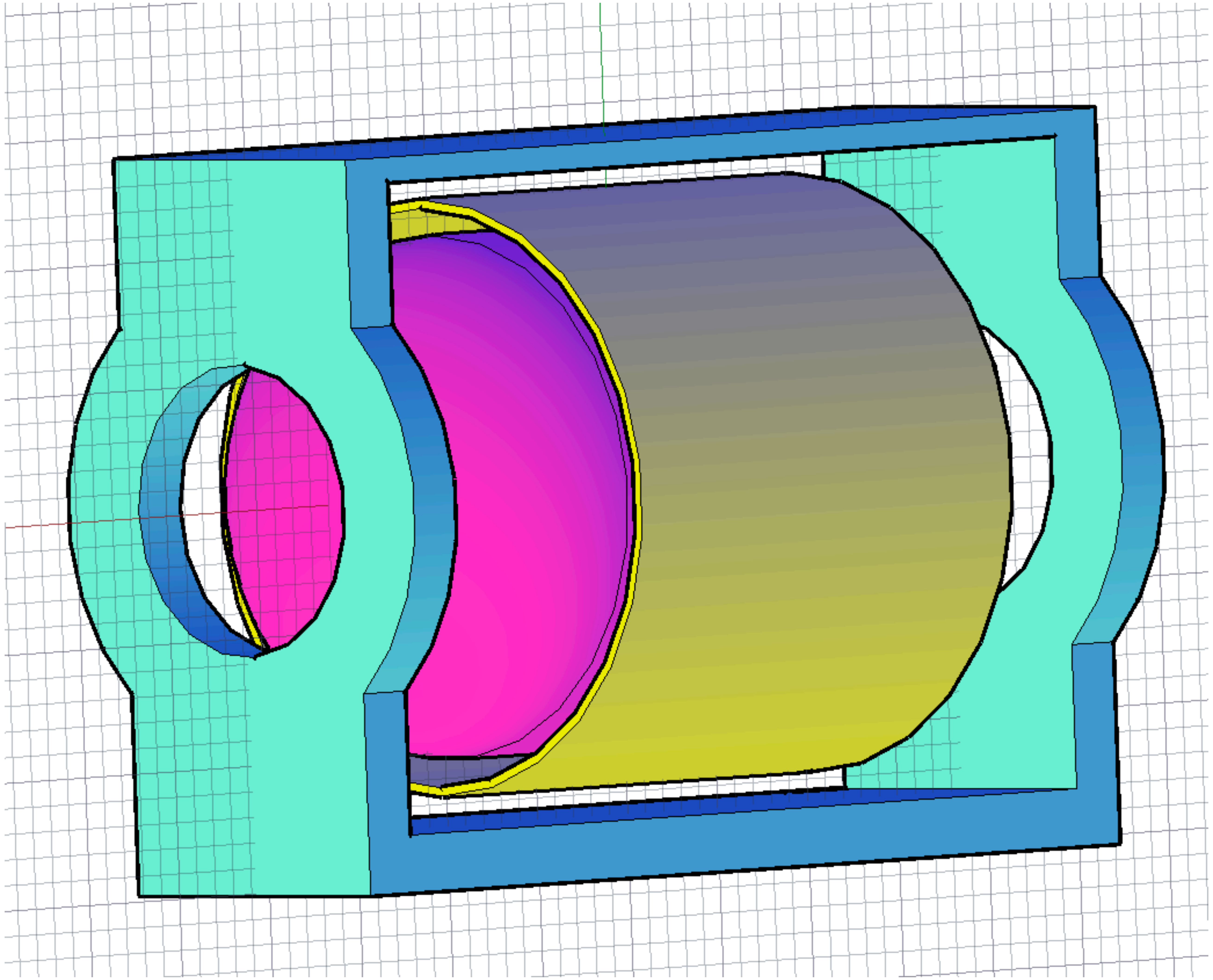
- The overall volume of TPC + calo is very large
- The clearance for the magnet is therefore "small"
- Integration of calo and magnet could help

- IF calo has layers of inactive material one could be replaced by the coil

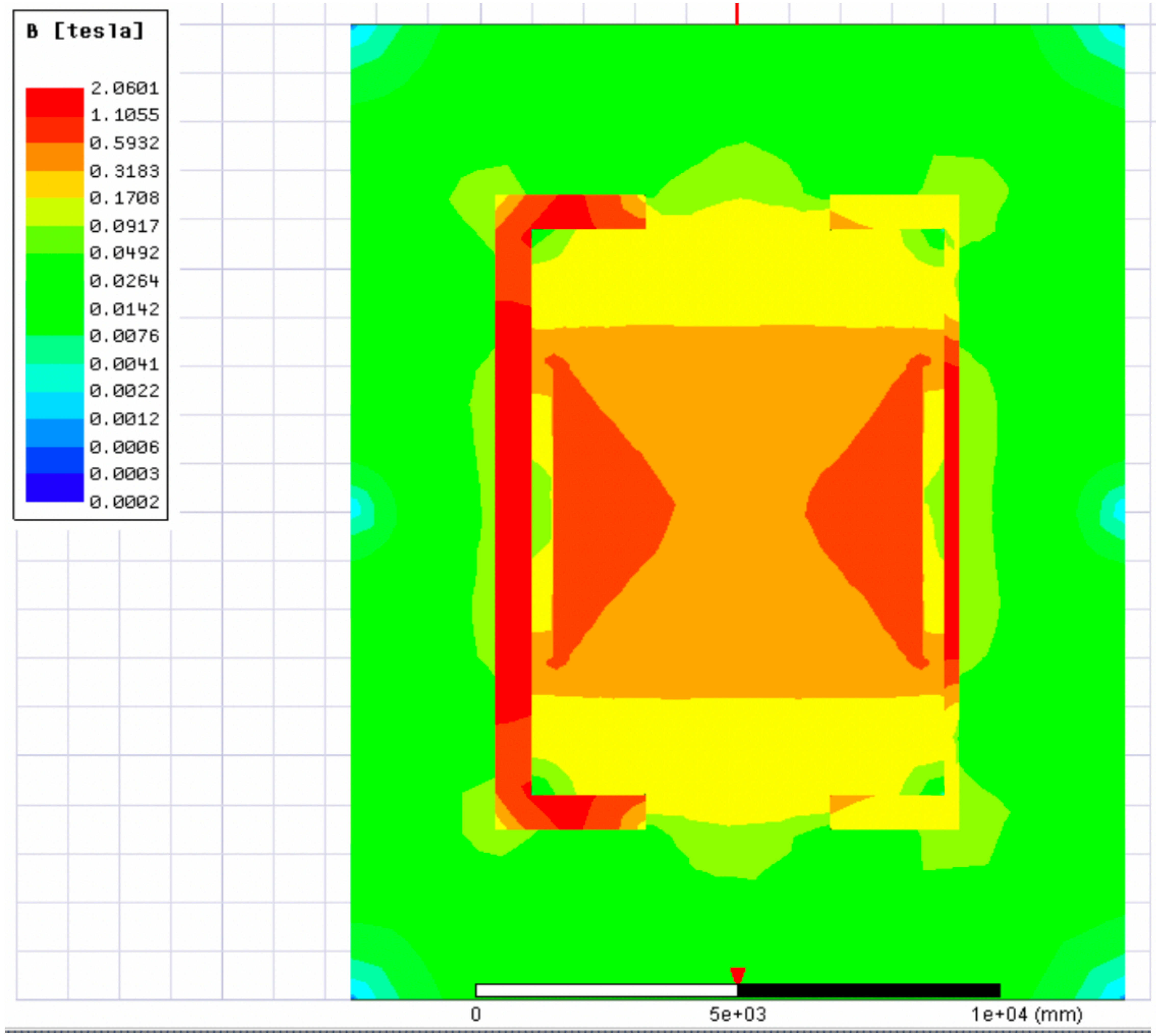
- Integration of magnet cryostat and calorimeter support structure is tough, but it could be extremely helpful for the case

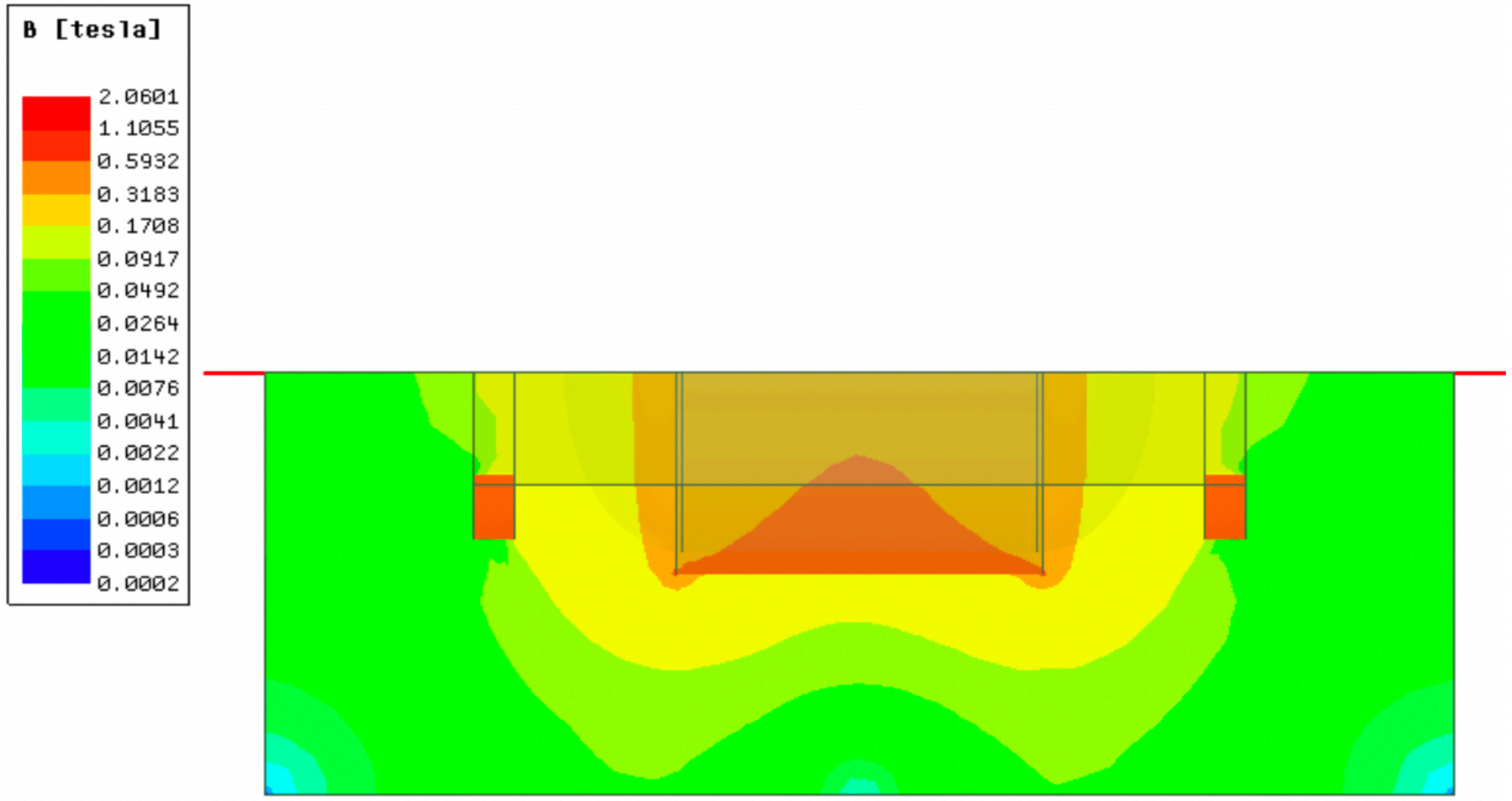
- With some iron for the flux return, a completely different scenario could arise

An additional possibility



Really not optimised field maps





Possible assembly sequence

- Lower beam is connected with lateral slabs
- Calorimeter is integrated "around" solenoid cryostat
- TPC is inserted via rails integrated in the calo-cryo sysyem
  - possibly calo "end-caps" can be assembled at this stage
- Detector is inserted laterally in the beams
- Top beam is finally mounted

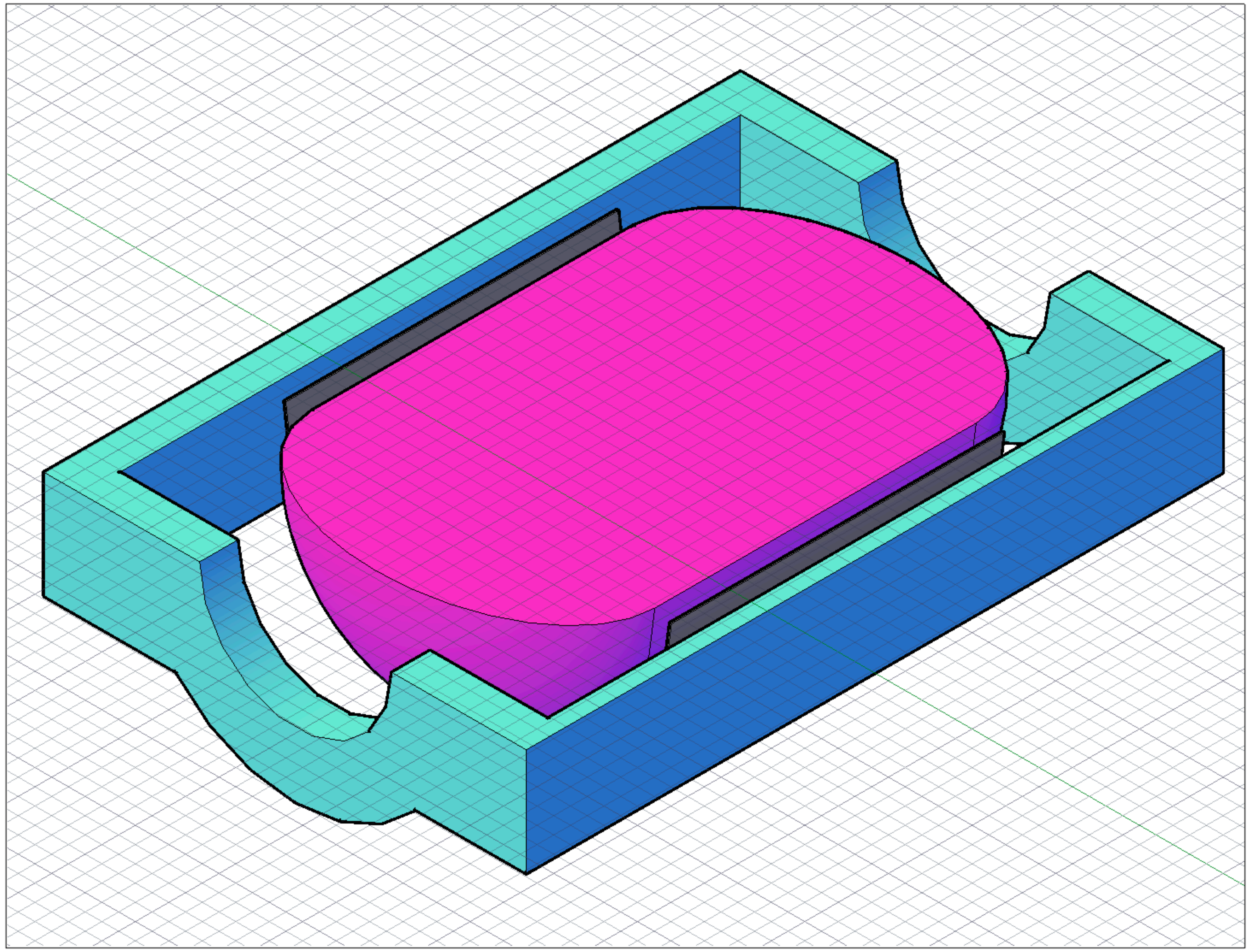
- A thin magnet (reinforced aluminium stabilised, à la MEG COBRA) could add in the mid of the calorimeter ˜ 18 g*cm of material (˜1.5 cm of lead)

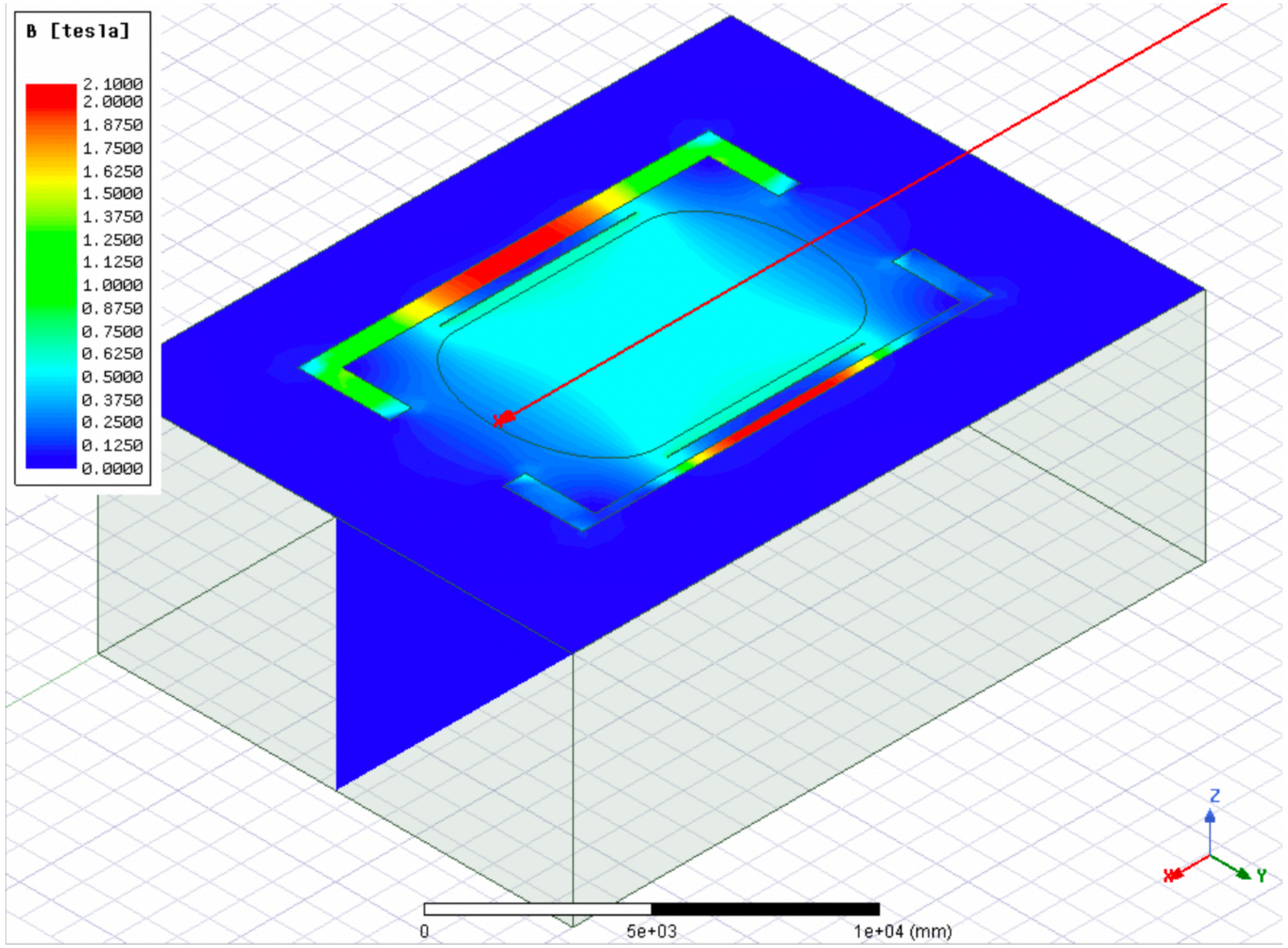
Magnet features

- Single (possibly double) layer solenoid
  - 6.2 m long
  - 7.8 m diameter
- Reinforced aluminium co-extruded cable
- ~1.1 T peak field in the conductor
- ~32 A/mm2 current density
- ~50 MJ stored energy
- 1.7 H with a 7500 A current

- Stray field yet to be optimised

Could this work?





INFN Sezione di Genova
Istituto Nazionale di Fisica Nucleare

Possible variation