



CERN North Area Multi-Purpose Superconducting Magnet Facility

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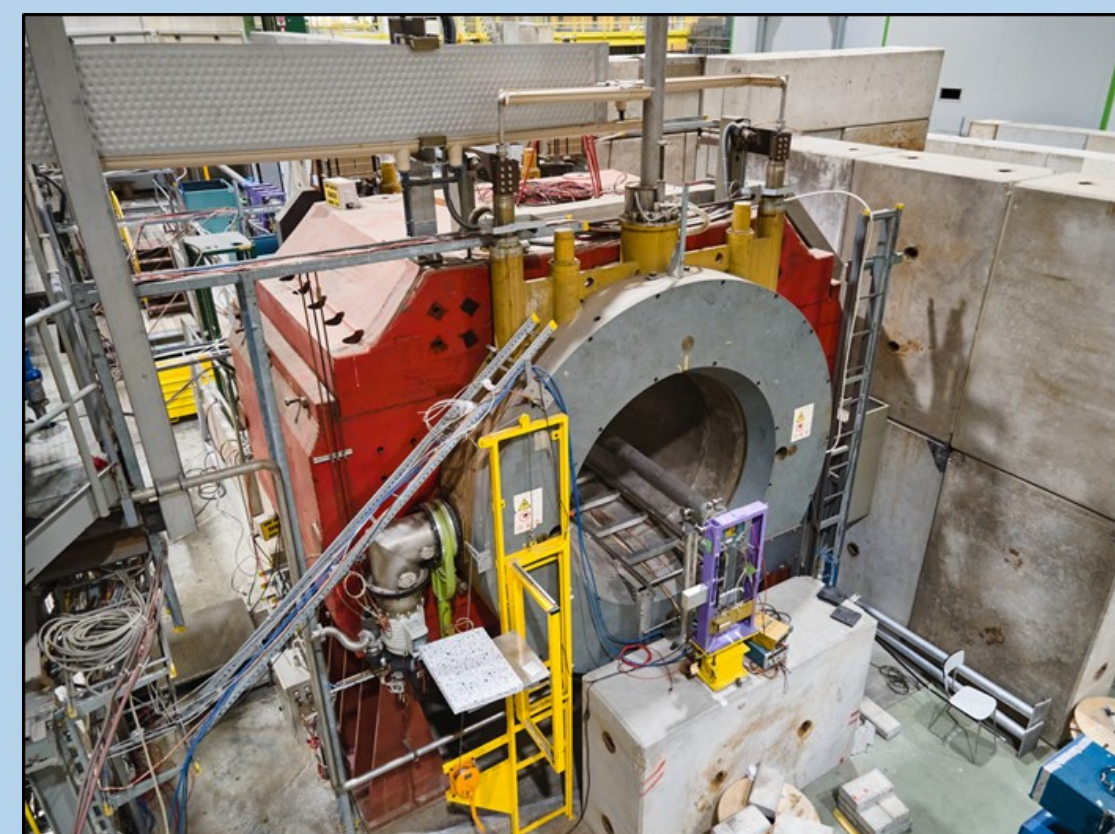
27th International Conference on Magnet Technology (MT27)
 Fukuoka, Japan / 2021

Poster ID: WED-PO2-114-02

Motivation and goal

A new multi-purpose superconducting magnet test facility is proposed to replace the current M1 and H8 Morpurgo magnets used since the late 1970s. These magnets, together with the proton beam of the Super Proton Synchrotron, provide unique possibilities of testing new detector technologies. The new magnet will feature a:

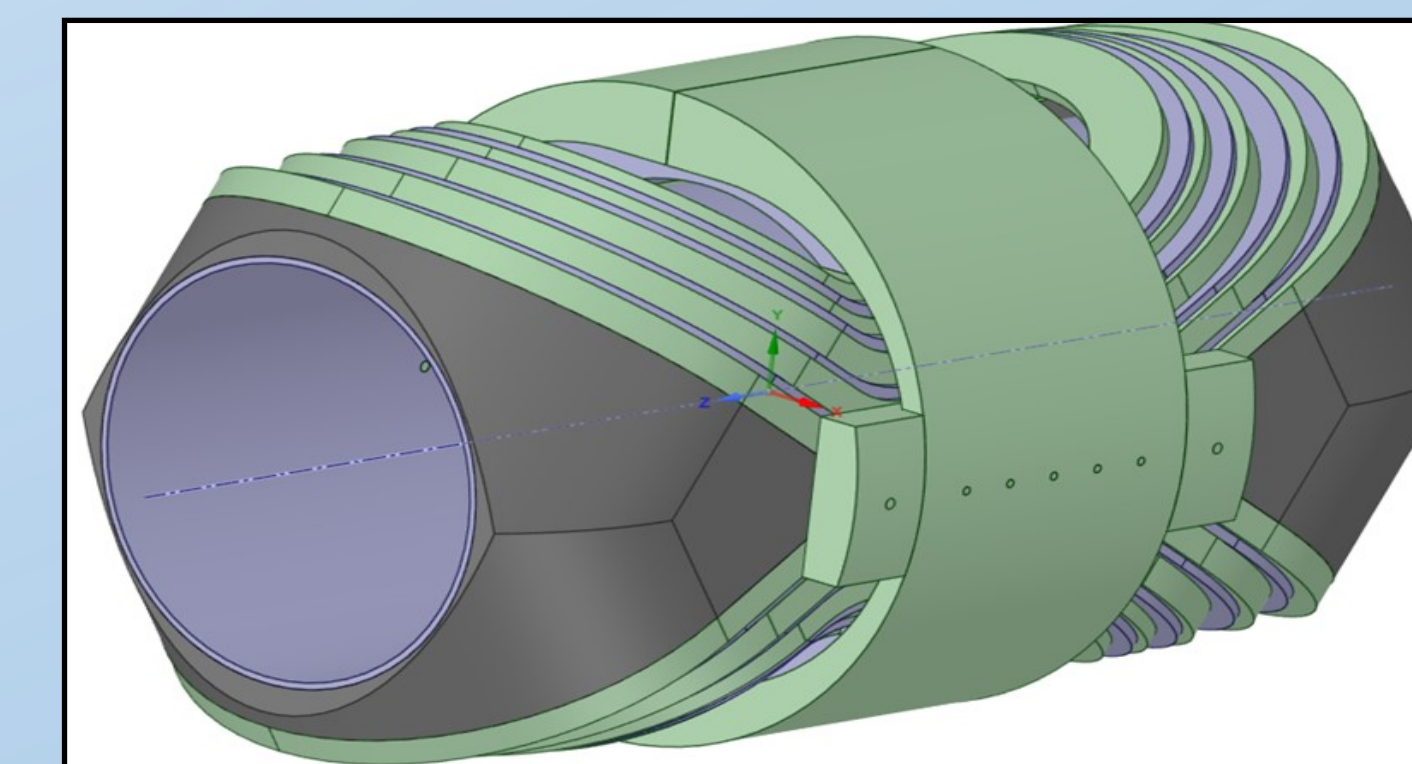
- 4 T central field
- 1 m³ testing volume
- Stray field less than 12 mT at a 5 m distance
- 4.5 K operation temperature (2 K of margin)



Current M1 and H8 magnets each with 3 T and 1.6 T central fields respectively.

The Magnadon

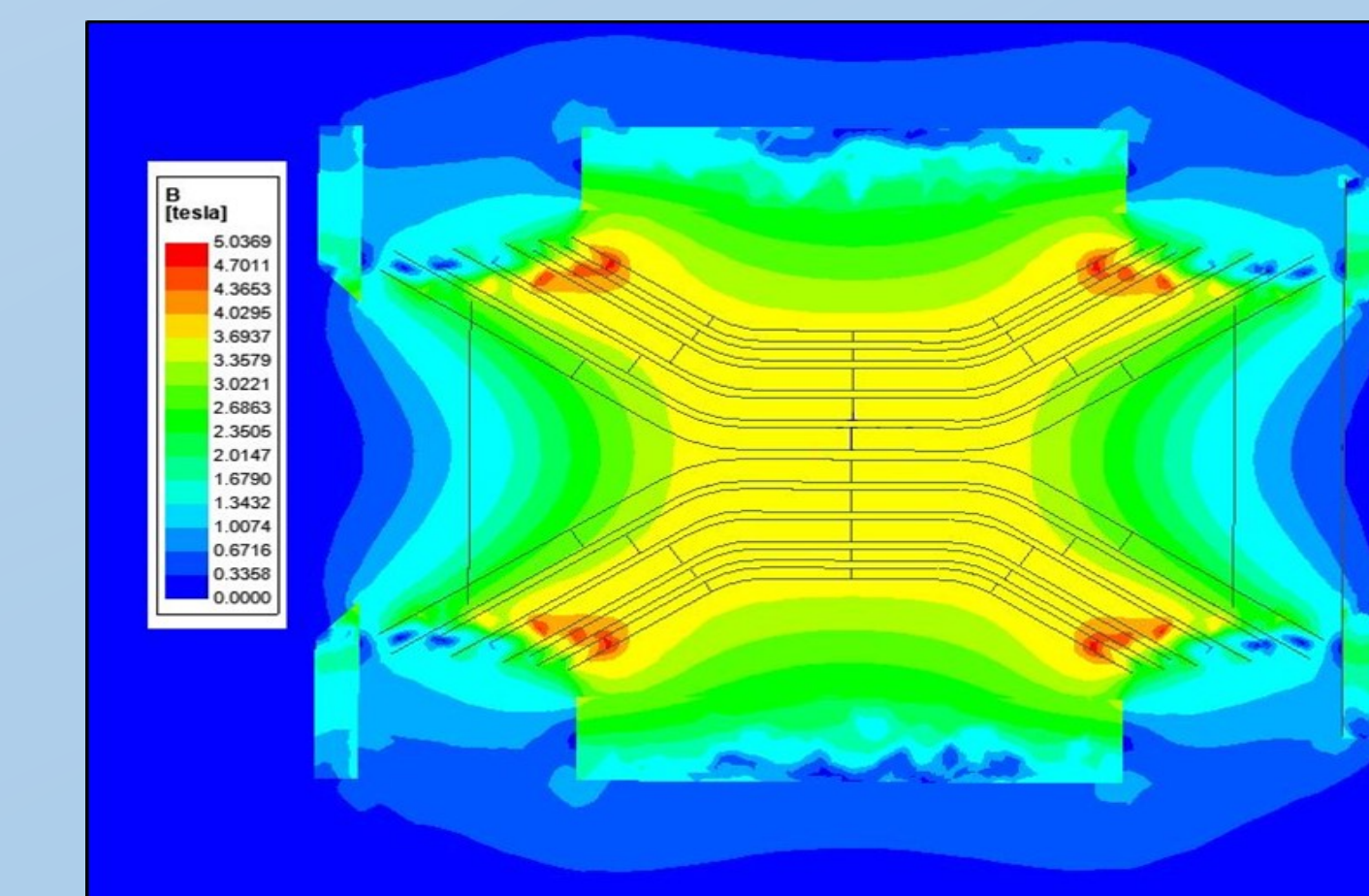
- The Magnadon (**MAG**net for **N**orth **A**rea with a **D**ipole **C**ONcept) has strong attraction forces at the edges (Megalodon jaws-like)
- It uses a flared end saddle type design
- Compatible with existing iron yoke of H8 magnet
- Achieves a significant field increase with respect to H8 magnet
- Higher field precision is preferred to high field homogeneity
- A special thanks to CEA - IRFU for fruitful discussions



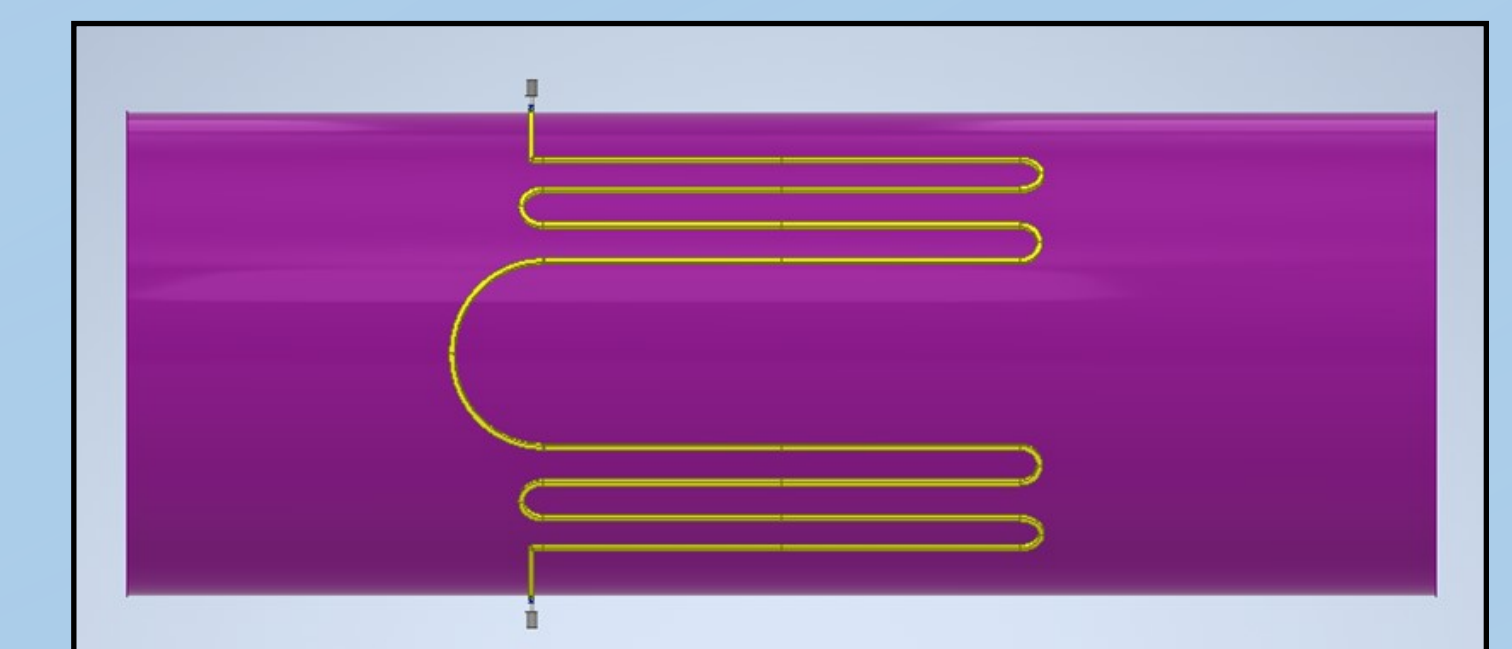
Magnadon coils with support structure



Jaw of Megalodon bearing similarities to coils



Field distribution along beam axis

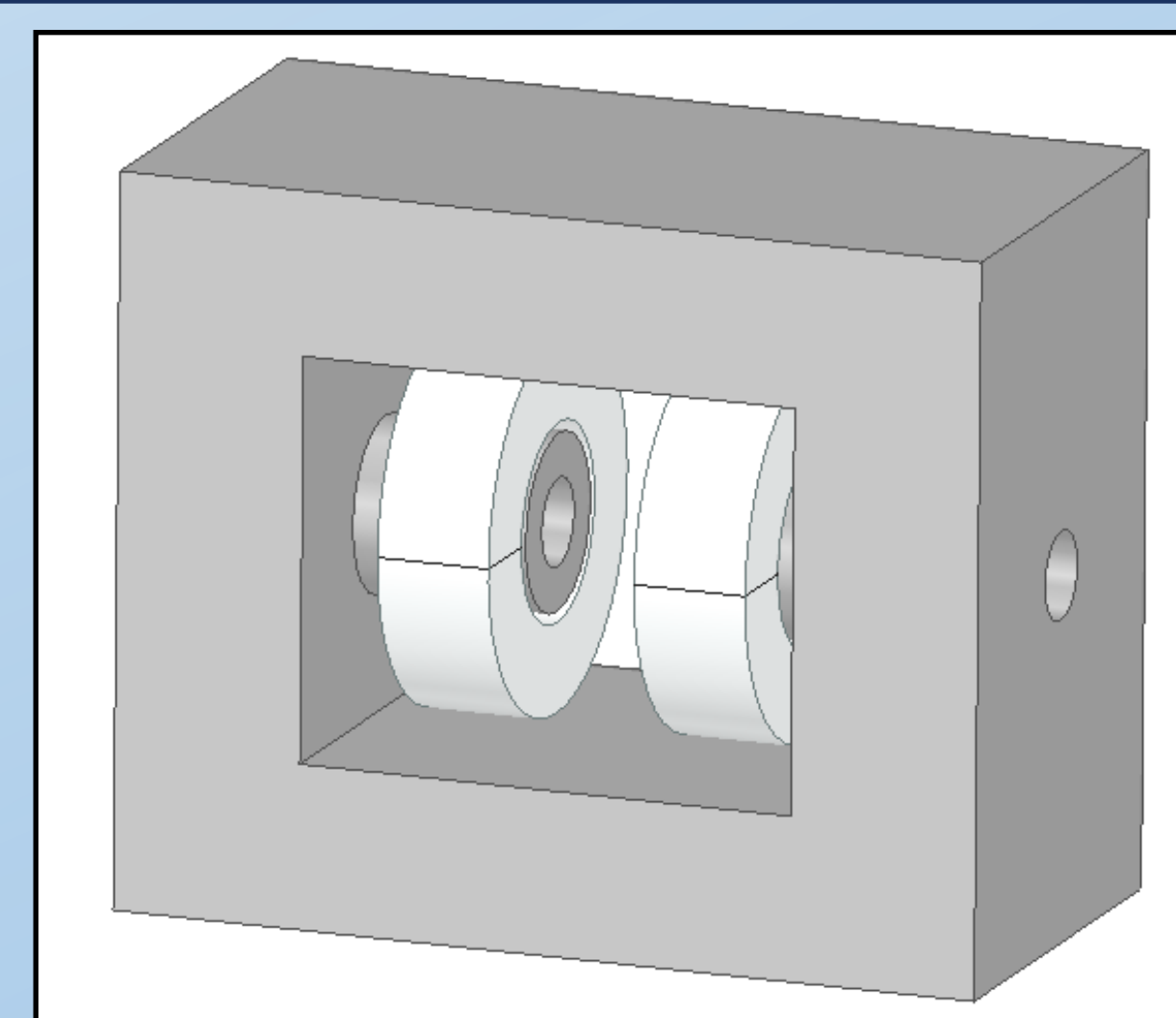


Thermo-siphon serpentine layout

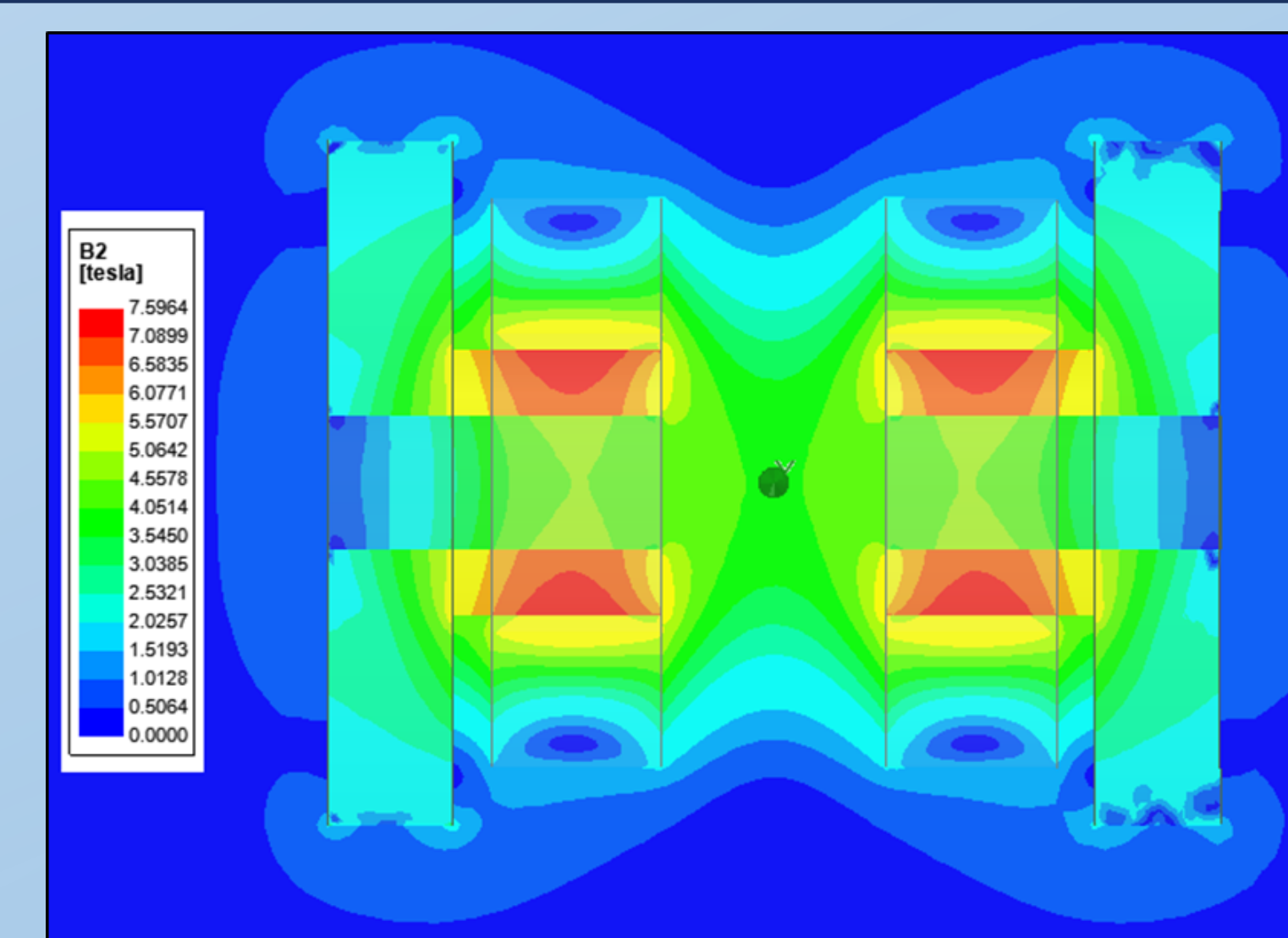
Specifications	
Field at Center	4 T
Free warm bore diameter	1400 mm
Total Stored Energy	80 MJ
Coil current	8 kA
Peak field in conductor	5.5 T
Stray field at 5 m	< 11 mT

The Split Coil Solenoid

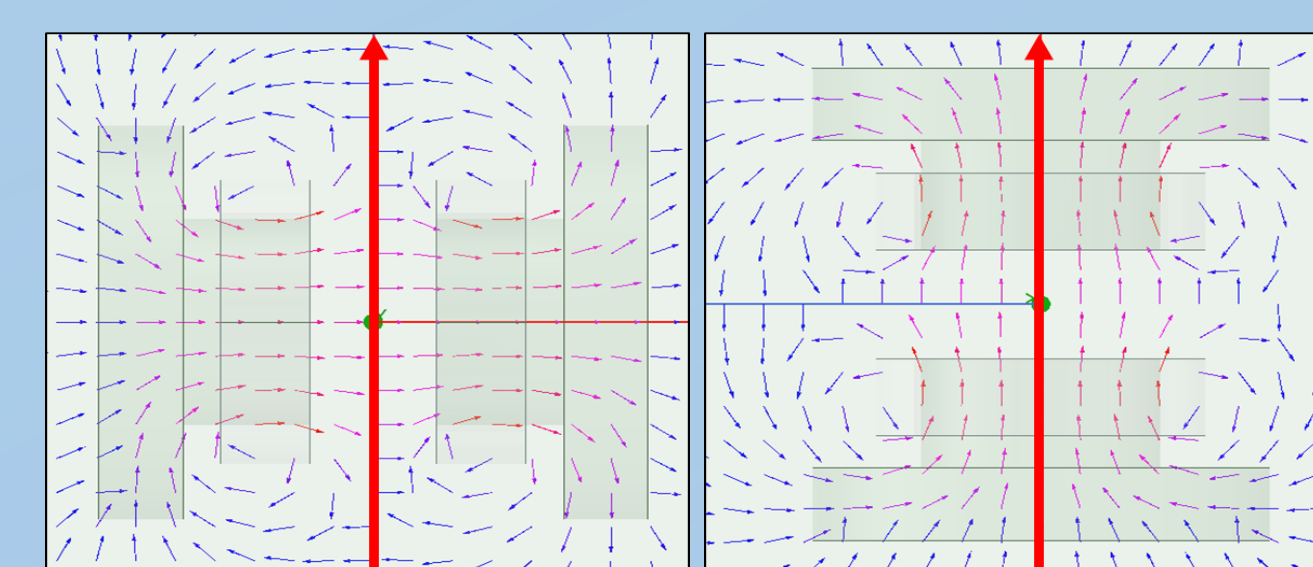
- The Split Coil Solenoid comprises two separate solenoids positioned with a free gap between each coil
- The presence of gaps through the iron yokes allows for the beam to be exposed to either transverse or axial magnetic field as needed
- Achieves a significant stray field reduction with respect to M1 magnet



Split eCoil Solenoid with large iron yoke to amplify central field, reduce conductor peak field and act as mechanical support



Field distribution along beam axis



Dual functionality allows beam to be orientated perpendicular or parallel to field

Specifications	
Field at Center	4 T
Free gap	1000 mm
Total Stored Energy	130 MJ
Coil current	8 kA
Peak field in conductor	5.68 T
Stray field at 5 m	< 9 mT

Advantages of concepts

The Split Coil Solenoid	The Magnadon
• Simpler mechanical support layout	• Lower weight
• Dual orientation of testing	• Compatible with H8 yokes
• Simpler manufacture	• Better field homogeneity
• Repeated coil pattern	• Larger aperture of 1.4 m

Conclusion and Outlook

- Within the context of CERN EP R&D, two preliminary magnet concepts are proposed as candidates for a future 4 T superconducting magnet system for the CERN North Area
- The ongoing studies consider feasibility in terms of mechanics, cryogenics, vacuum vessel and supporting superconductor technologies
- Both magnets are found to be compatible with aluminium-stabilised Niobium-Titanium technology and so far no show-stoppers have been identified