



D2 for FCC
P.Fabbricatore INFN Genova

FCC week 2015
23-27 March 2015
Marriott Georgetown Hotel

D2 for FCC

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Presented by E.Todesco (CERN)

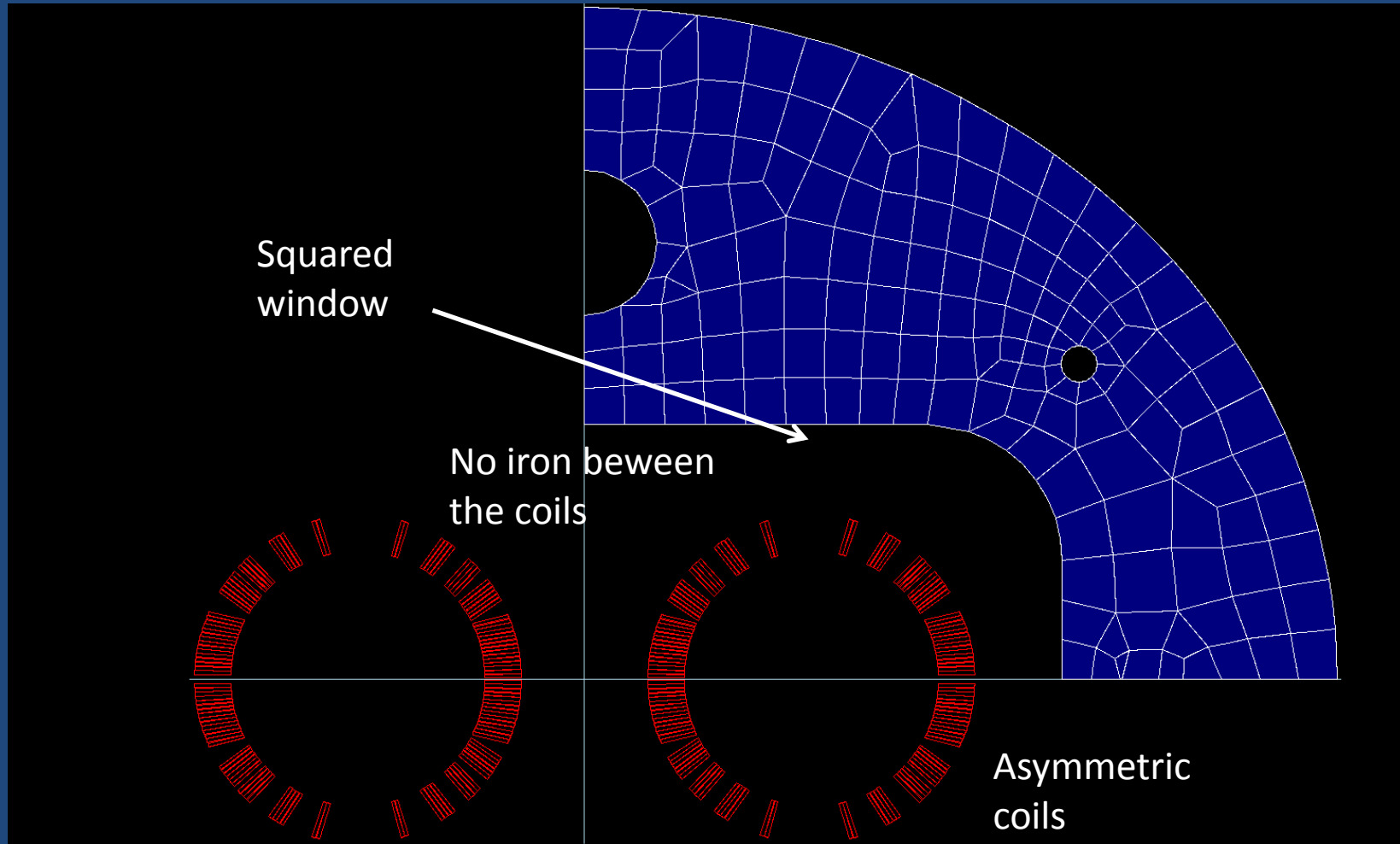
- From the D2 of High Luminosity LHC to D2 of FCC
- Possible magnetic lay-out
- Some ideas about mechanics
- R&D needs?

D2 for LHC luminosity upgrade

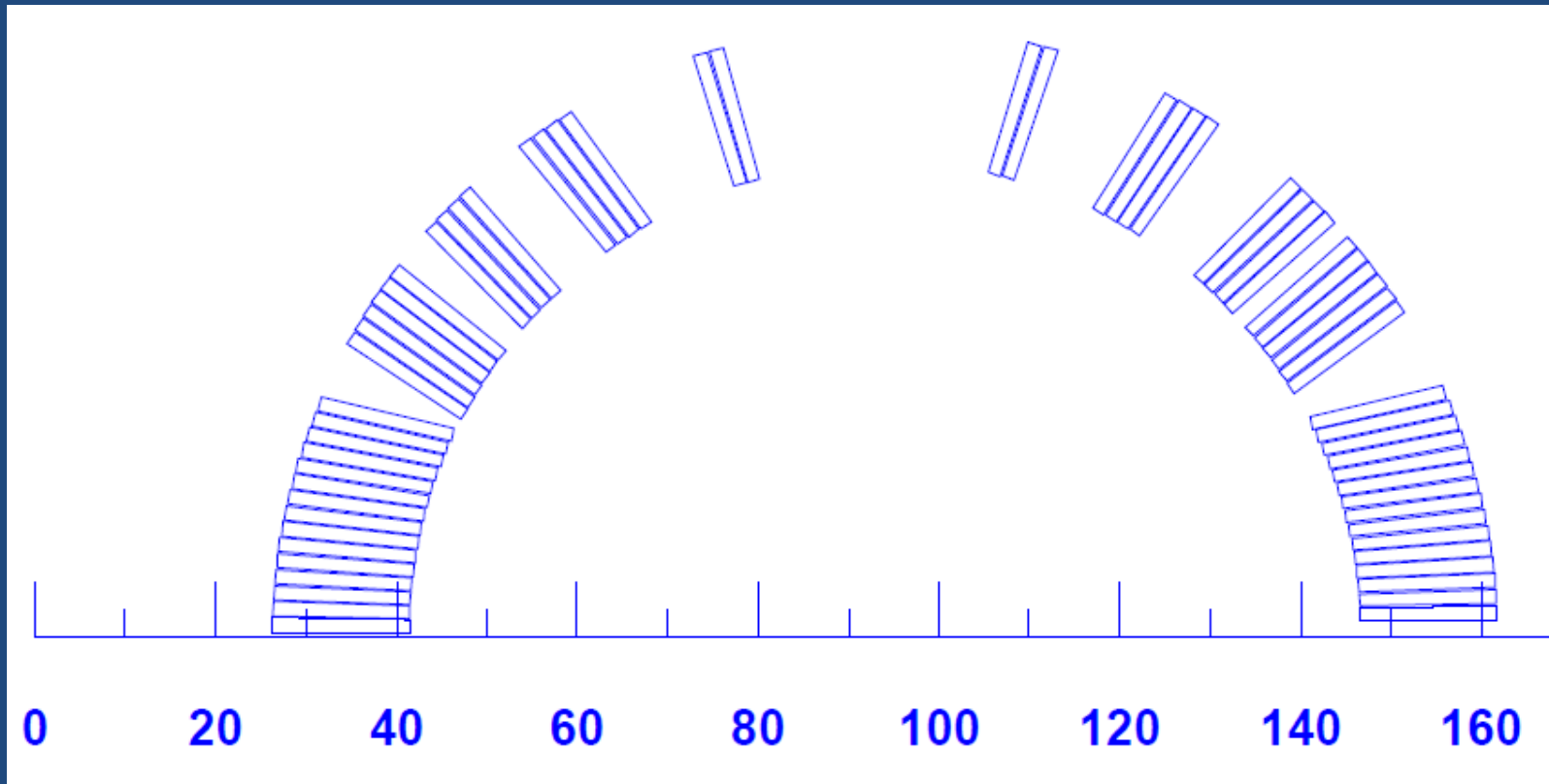
INFN Genova is working on D2 design for the Luminosity Upgrade of LHC, a 4.5 T two-in-one dipole with 105 mm aperture and 8 m length. The main problem to be solved is the cross talk between the two coils leading to high values (tens of units) of unwanted multipoles (mainly b_2 , b_3 , b_4 and b_5). In order to decouple the magnetic field in the two apertures a strategy has been developed based on two main points:

- a) Almost squared iron window and consequently no iron is placed between the coils;
- b) each coil is asymmetric in a way to cancel the magnetic cross talk each other.

The Lay-out of Hi Luminosity D2

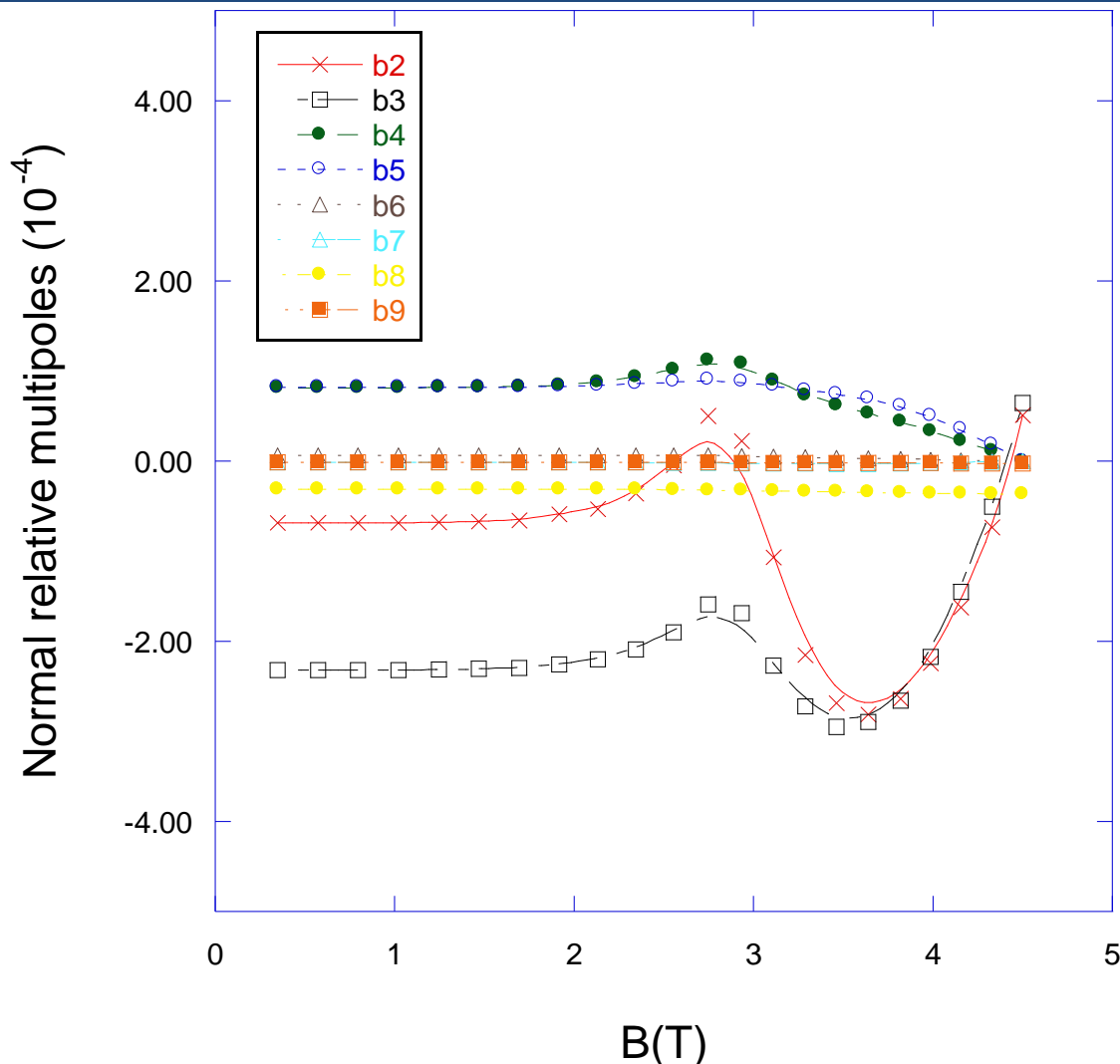


Hi Luminosity D2 Detail of Asymmetric Winding



After some iteration with mechanics the coil was optimised with conductor dimensions at 70 MPa

Hi Luminosity D2 - Multipoles



From Hi Luminosity D2 → FCC D2

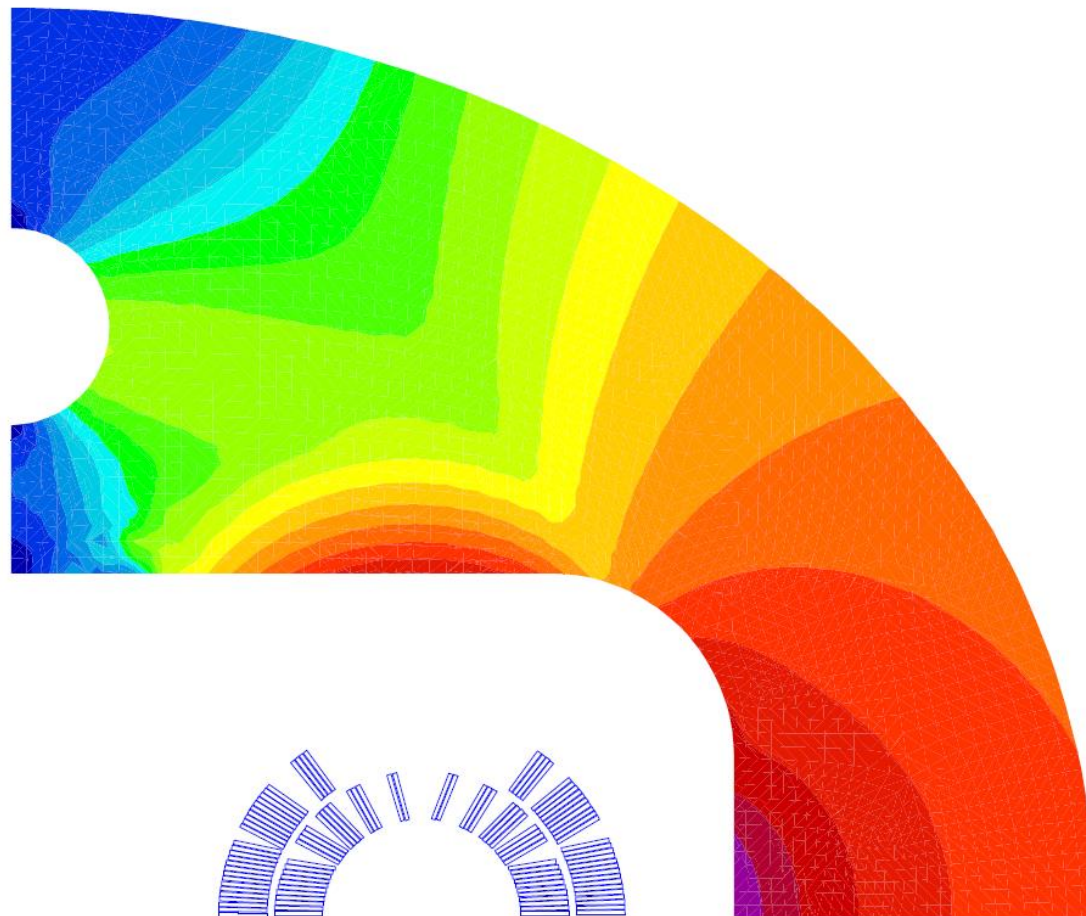
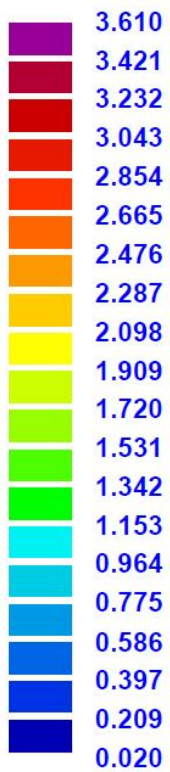
We have investigated the possibility of extending the same layout to FCC D2. The following basic parameters were considered:

- Integrated field 100 Tm
- Central field 10 T (→ 15 m long magnet)
- Peak field 10.5 T
- Aperture 60 mm
- Distance between apertures 250 mm

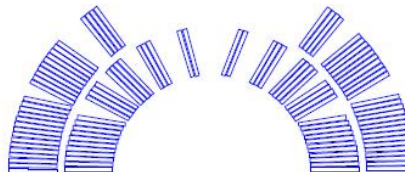
The Nb₃Sn conductor involved in the design of the 11T twin aperture for LHC Hi Luminosity was taken into consideration

A promising optimised D2 FCC lay-out

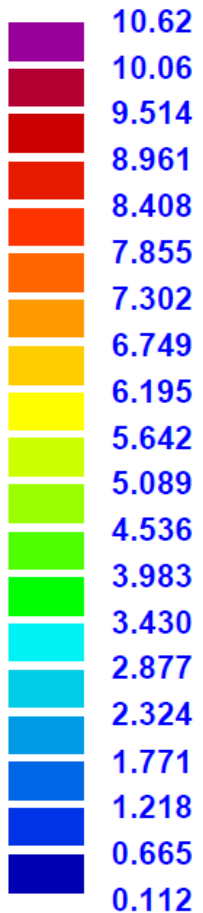
|B| flux density (T)



ROXIE_{10.2}

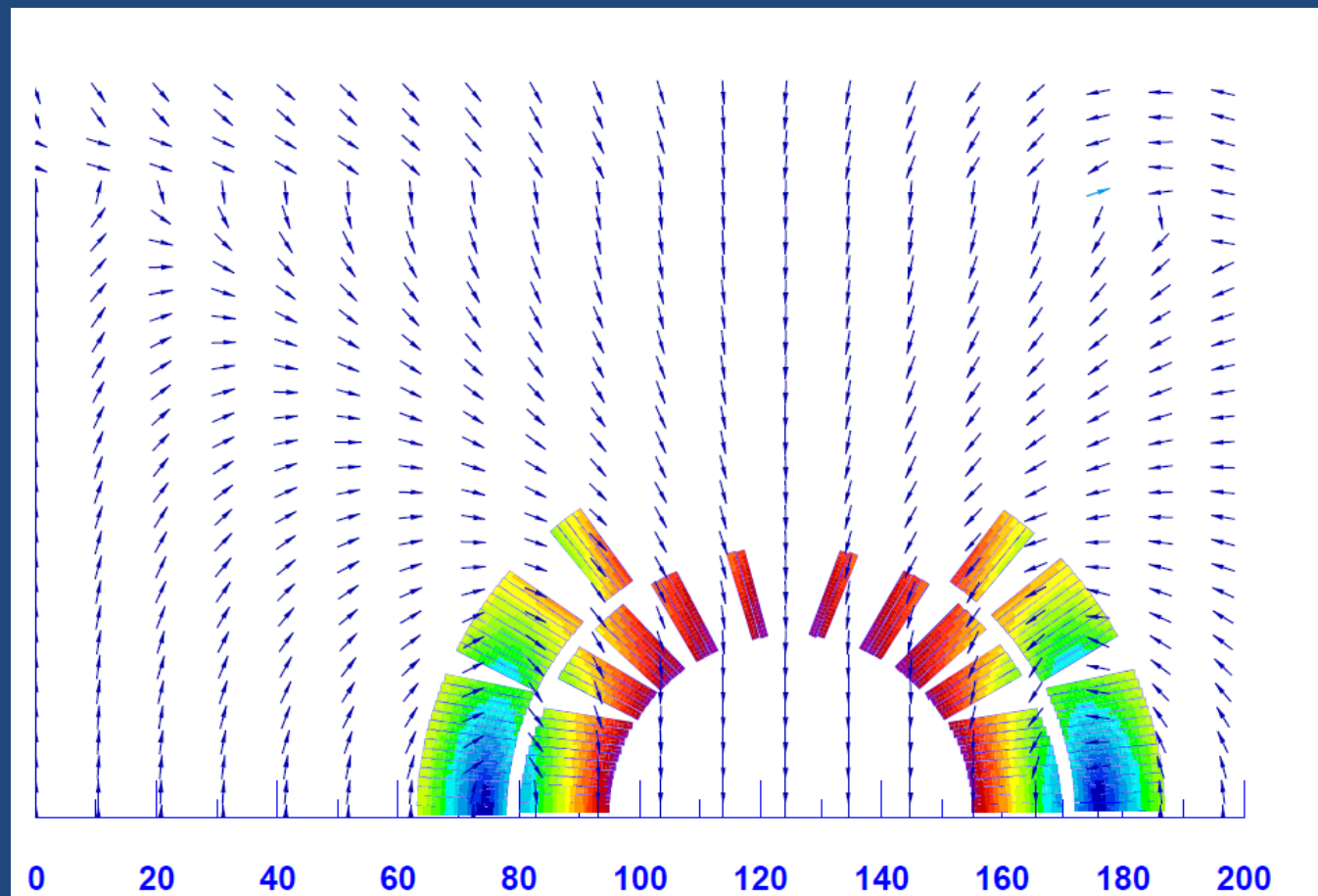


$|B|$ (T)



ROXIE_{10.2}

Peak magnetic field 10.62 T





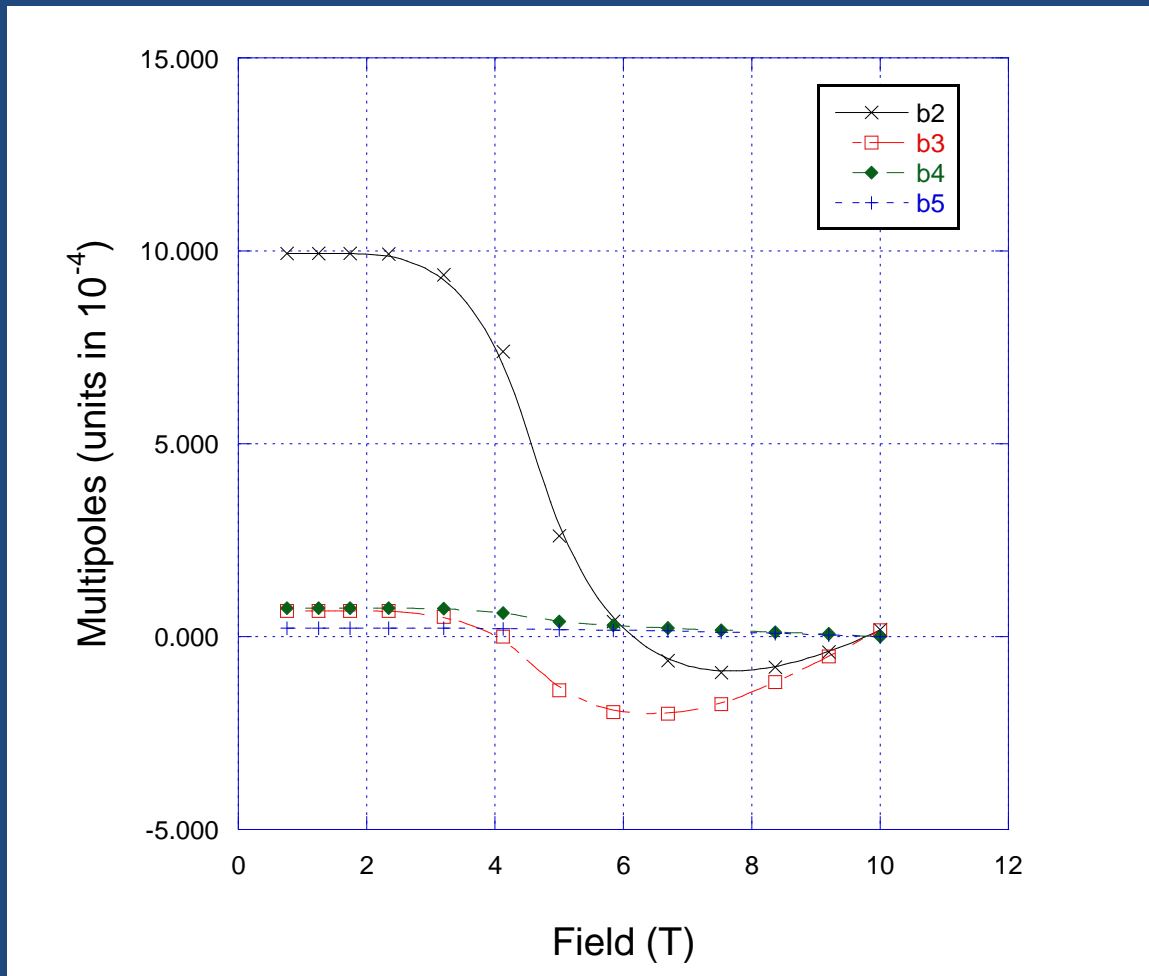
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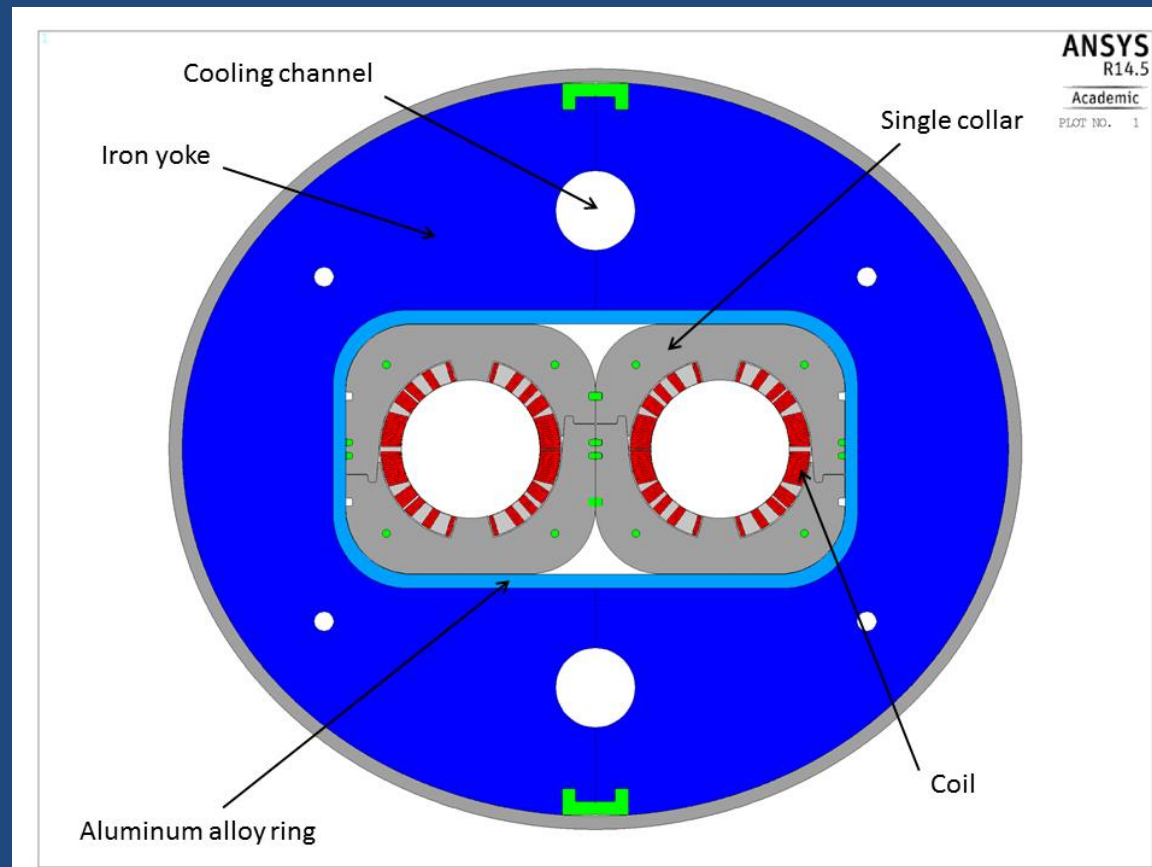
Main Characteristics

Characteristics	Units	Value
Aperture	mm	60
Number of apertures		2
Distance between apertures	mm	250
Cold mass outer diameter (min/max)	mm	570/670
Magnetic length	m	10
Bore field	T	10.00
Peak field	T	10.62
Number of turns		53 (24 +29)
Current	kA	12.430
Temperature	K	1.9
Loadline margin	(%)	25
Stored energy per meter	MJ/m	0.2807
Differential inductance per meter	mH/m	9.48
Stored energy	MJ	11.4
Differential inductance	mH	140

Multipoles in 40 mm diameter vs magnetic field (geometrical + iron saturation)

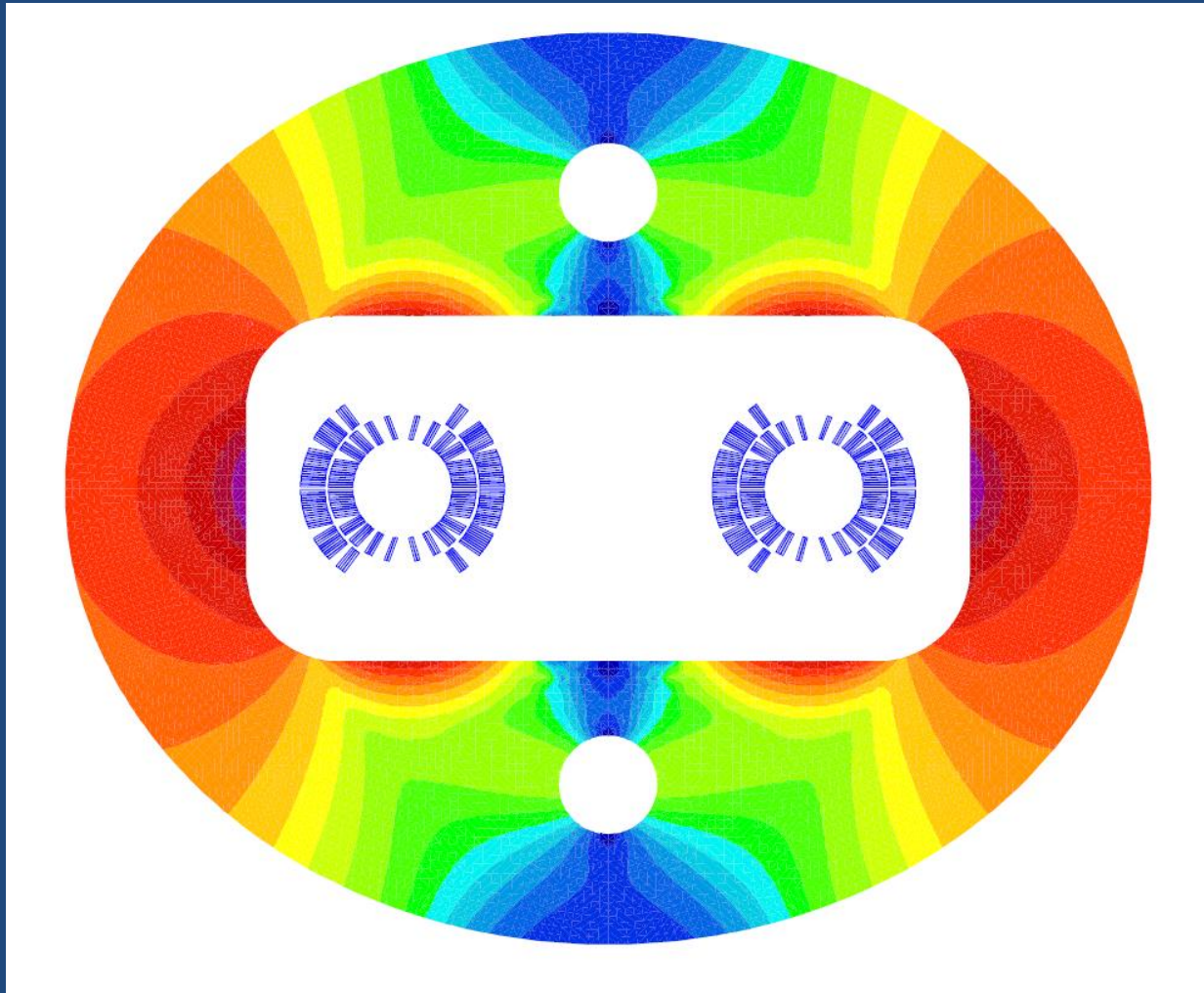


Some ideas about mechanics: it looks that the solution for the Hi Lumi D2 mechanics could be extended to D2 for FCC.
Single collared coil + Al containment of collared coil inside the iron flux return having no mechanical function.



Conclusions

- The design concept developed for High Luminosity D2 can be extended to FCC D2
- The field quality can be excellently controlled
- In principle the mechanics could follow the same approach of HL D2
- No special R&D is presently envisaged, but the finalization of the design and the construction of a short model.



Thank you for your attention