Compact magnet design

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On behalf of EuroCirCol WP5 and the FCC-hh Magnet Development Program

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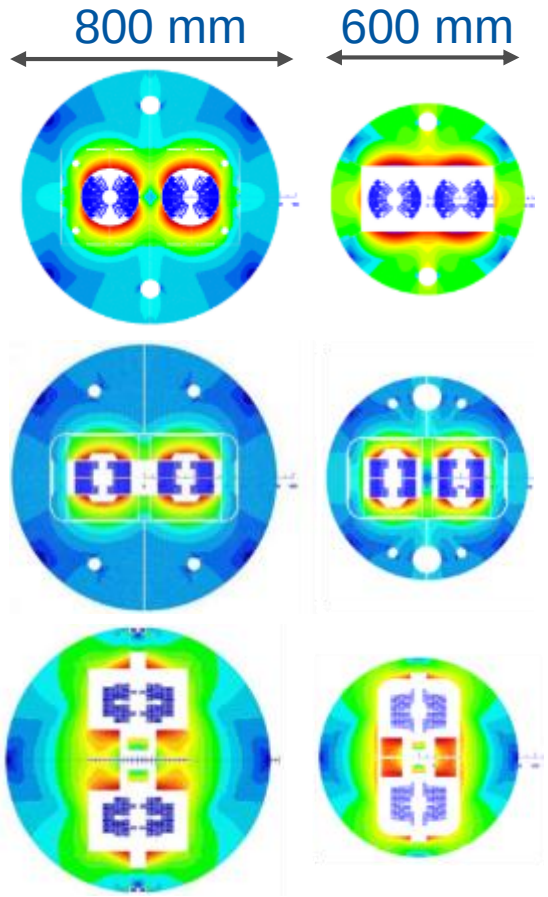
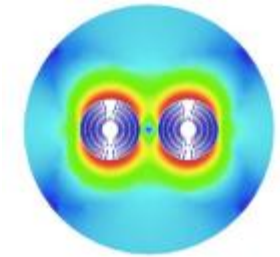
Magnet Design Options



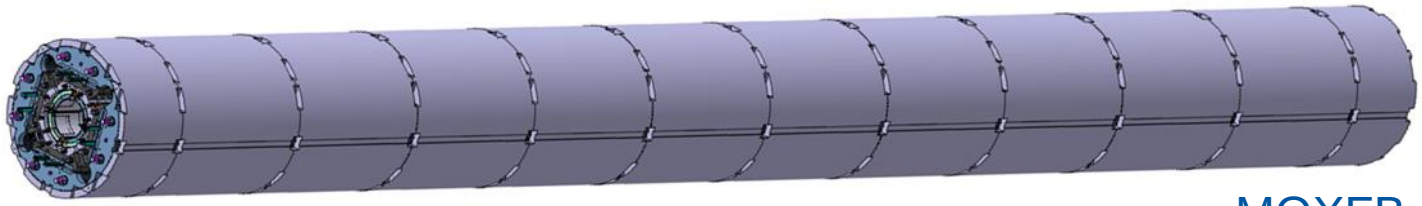


CCT (PSI with LBNL and CERN)

Magnet length	14.3 m
Free physical aperture	50 mm
Inter-beam distance	204 mm
Field amplitude	16 T
Margin on the load-line @ 1.9K	14 %
Total time margin	40 ms
Critical current density @ 1.9 K, 16T	2300 A/mm^2
Conductor fit (J_c/B)	EuroCirCol fit
Degradation due to cabling	3%
Minimum Cu/nonCu	0.8
Maximum strand diameter	1.2 mm
Maximum stress on conductor at warm	150 MPa
Maximum stress on conductor at cold	200 MPa
Maximum hot spot temp. (@ 105% I_{nom})	350 K
Maximum number of strands in a cable	40 - 60
Maximum voltage to ground (magnet)	1.2 kV
Maximum TOTAL voltage to ground	2.5 kV
Conductor cost (performance based)	5 Euro/kAm

Curved compact dipole magnets

- LHC dipole magnets were produced straight and then curved in a press before welding the outer shell
- The current baseline foresees a bladder and key structure with approximately 0.8 m long aluminum shells
- Making the segments shorter ‘Aluminum collar shell’ may allow bending the structure without concentrating the stress at few positions
- Using Invar (FeNi36) as yoke material may allow to replace the Al shell (sufficient pre-stress and compensating the lower magnetic saturation may not allow for smaller overall size, studies are on-going)
- Collaring and using yoke materials with larger stress limit may allow to further reduce the overall size (explorative studies will start soon)



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