COLD MASS OF THE 11 T DIPOLE FOR THE DS REGIONS OF LHC

WP11

Conceptual specification EDMS 1366582

Ref. LHC-MBH-ES-0001

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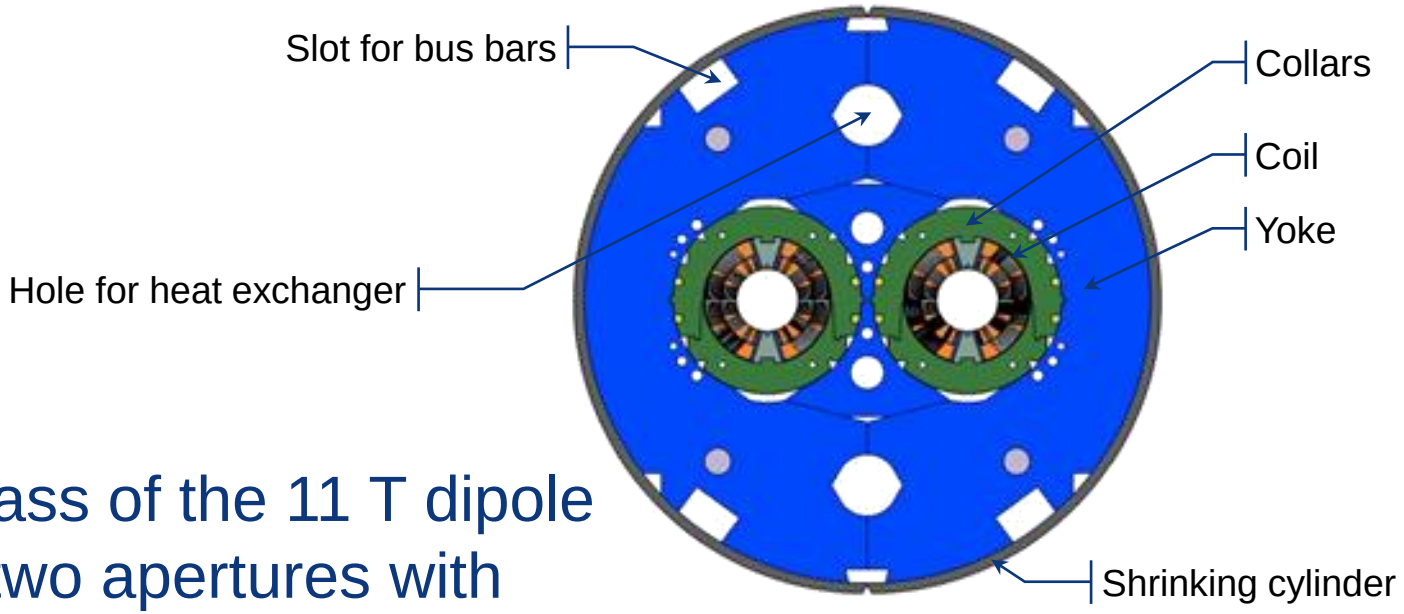
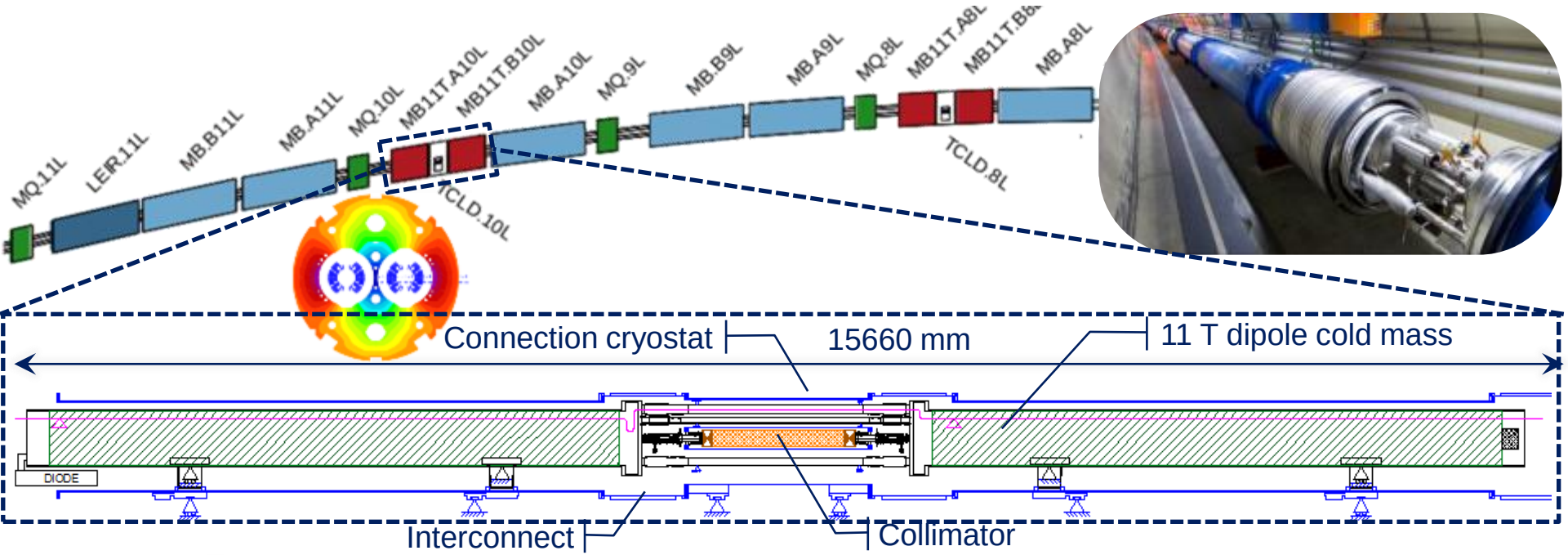
Scope



- The cold mass of the 11 T dipole comprises two apertures with coils of about 5.5 m length assembled in separate collars. Two cold masses of the 11 T dipole will produce an integrated field of 119 Tm at 11.85 kA, which corresponds to the bending strength of the LHC main dipole
- The 11 T dipole will be connected in series with the LHC main dipoles

Benefit

- Create space in the dispersion suppressor regions of LHC to install additional collimators, which are needed to cope with beam intensities that are larger than nominal, such as in the High Luminosity LHC (HL LHC) Project



Performance objectives

- Provide an integrated field of 119 Tm at 11.85 kA (the nominal operation current of the LHC main dipoles), which corresponds to a nominal field of 11.25 T at the center of the bore. It shall be obtained with a margin of ~20% on the magnet load line
- Geometric field quality with low-order field errors below 10^{-4} unit
- To avoid deformation of the beam closed orbit, the transfer function of the 11 T dipole shall be identical to that of the main dipole … which is not possible in the entire operation range (different Transfer Function)
- Can be mitigated by adding dedicated trim power converter, or using standard orbit correctors in the LHC lattice (but in case of failure …)
- The 11 T dipole will be straight (brittleness of Nb_3Sn), and equipped with the same CBT and BS as the present curved dipole to facilitate integration
- To mitigate the corresponding reduction of mechanical aperture, the two cold masses of a cryo-assembly will be assembled with an angle of 2.55 mrad relative to each other, and shifted by 0.8 mm towards the center of the LHC

Operational conditions

- The magnet will operate at 1.9 K in superfluid helium up to a nominal current of 11.85 kA
- Protected with quench heaters and a by-pass diode operating at cold, integrated to the cold mass assembly

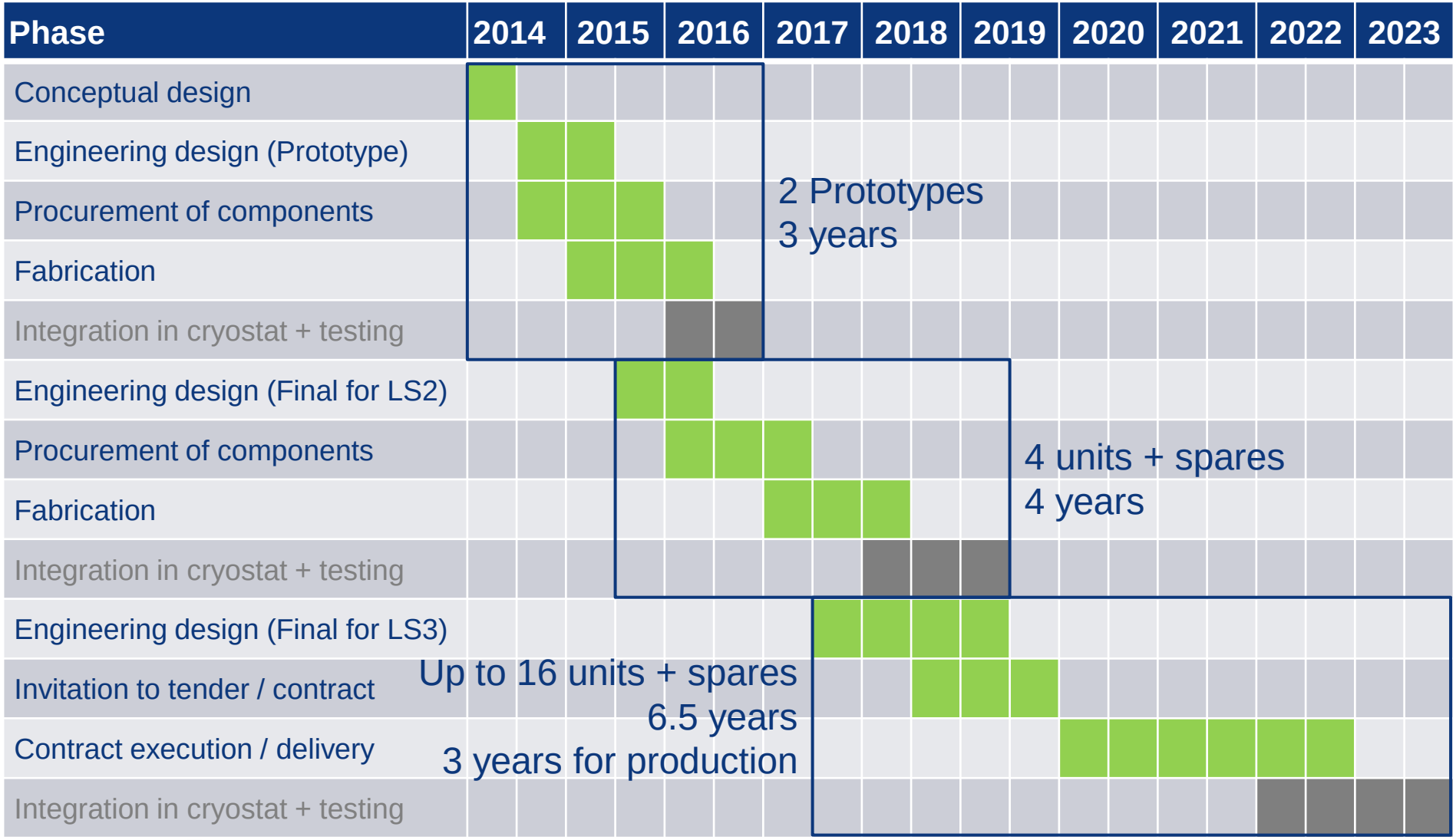
Radiation resistance

- The 11 T dipole cold mass will be designed for 5 MGy

Shopping list

- Two full-length prototypes to validate the design, the overall performance in nominal operation conditions, and the different interfaces with the neighbour systems (the prototypes may become spares)
- For LS2, around IP2, 4 units to replace 2 main dipoles MB.**A**10L2 and MB.**A**10R2
- For LS3, around IP7, 8 units to replace 4 main dipoles MB.B8L7, MB.B10L7, MB.B8R7, and MB.B10R7
- For LS3 to be confirmed, around IP1 and IP5, up to a maximum of **16 units to replace 8 main dipoles**, location to be defined

Schedule


Phase
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Conceptual design
Engineering design (Prototype)
Procurement of components
Fabrication
Integration in cryostat + testing
2 Prototypes
3 years
Engineering design (Final for LS2)
Procurement of components
Fabrication
Integration in cryostat + testing
4 units + spares
4 years
Engineering design (Final for LS3)
Invitation to tender / contract
Contract execution / delivery
Integration in cryostat + testing
Up to 16 units + spares
6.5 years
3 years for production