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Design Study of a Novel, LHC High-Lumi CCT Orbit Corrector.

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The Large Hadron Collider (LHC) upgrade, called High Luminosity LHC (HL-LHC) is planned for the next decade. A wide range of magnets and new technologies are currently under development. One of these systems will be a set of twin aperture beam orbit correctors positioned on the approaches to the ATLAS & CMS experiments. This twin aperture magnet system, with large 105 mm clear aperture coils. Each aperture will independently deliver 5 Tm integral field, between apertures the field vectors are rotated by 90° from each other, and individually powered. the base-line magnet design length is forced to be longer than 2.2m due to the cross talk that limits the maximum field to about 2.6 tesla. Above this field errors that are generated in the adjacent aperture exceed the beam optics limit. Within the string of magnets there is limited space between the D2 dipole and the crab cavities. CERN is working on fine adjustment to give extra centimetres of space.

This paper presents a novel solution to reduce the length of this magnet design significantly from that 2.2 m baseline, to a 1.4 m long 4 Tesla design. Utilizing a selection of novel techniques we present a high field design which eliminates totally the adjacent field errors throughout the full bipolar current range. The design uses a set of Canted Cosine Theta ‘CCT”air coils with a system of correctors which run in series with each apertures main dipole coils and council totally the errors for both apertures. We present :field quality, quench calculations, assembly structure within the D2 cold mass. The design liberates ˜ 1 m of axial space within the D2 cold mass. We also present a comparative cost estimate between the base line design and this CCT air coil design.

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