Contribution ID: **353** Type: **Regular 15 minutes Oral Presentation**

Electromechanical Design of a 16-T CCT Twin-Aperture Dipole for FCC

Monday, August 28, 2017 6:15 PM (15 minutes)

The CCT (Canted Cosine Theta) Technology has been studied for its suitability for an FCC main dipole in terms of magnetic and mechanical performance, electro-thermal protectability, as well as efficiency. In this paper we present lessons learnt from our search for efficient CCT solutions by means of 2-D magnetic and mechanical simulations, discuss the 3-D periodic mechanical model, as well as 3-D electromagnetic analysis of the end regions. Temperature and voltage distributions during a quench under simplifying assumptions are discussed. Eventually, we present quench propagation in CCT-type high-field magnets, and how it may impact quench detection when compared to classic cosine-theta coils. Several new insights into efficient CCT design could be gleaned from these types of analyses and are summarized.

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Session Classification: Mon-Af-Or7

Track Classification: A1 - Superconducting Accelerator Magnets