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Two-layer 16 Tesla $\cos\theta$ dipole design based on MQXF Low-Beta Quadrupoles

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High Energy LHC is a study aimed at exploring the possibility to upgrade the present LHC ring to reach 25 TeV total collision energy which requires 16 Tesla dipoles. Upon the conclusion of the High Luminosity Upgrade, the US LHC Accelerator Research Program in collaboration with CERN will have extensive Nb₃Sn magnet fabrication experience. This experience includes robust Nb₃Sn conductor and insulation scheming, 2-layer $\cos 2\theta$ coil fabrication, and bladder-and-key structure and assembly. By making evolutionary rather than revolutionary improvements and modification to existing technology the feasibility of a LARP-type 16 Tesla dipole is investigated. Preliminary designs indicate that fields up to 16.4 T are possible with current grading and 15.9 T are possible with conductor grading both while satisfying the HE-LHC specifications. Key challenges include accommodating high-aspect ratio conductor, narrow wedge design, conductor and current grading, and especially quench protection of a 16 T device.

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