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Beyond 15 T: The Future of Superconducting Magnet Technology.

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The high-energy physics (HEP) research in the post-LHC era relies on a next circular collider. The energy of a circular collider is limited by the strength of the bending dipoles, and its luminosity by the strength of the final focus quadrupoles. These considerations explain the continuous interest of the HEP and accelerator communities to stronger superconducting (SC) accelerator magnets. The ultimate field of SC magnets is limited by the upper critical field B_{c2}, critical temperature T_c and critical current density J_c of the superconductor. The maximum field of the Nb-Ti magnets used in present high-energy machines, including the LHC, is limited to ˜10 T at 1.9 K. The fields above 10 T are now possible thanks to the recent progress with the Nb_3Sn composite wires and the associated magnet technologies. It was shown that Nb_3Sn magnets can operate at fields up to ˜15 T. To move beyond 15 T requires high-field high-temperature superconductors (HTS), such as BSCCO and REBCO. Operation above 15 T also put additional requirements to magnet design, technologies and performance. Due to the substantially higher HTS cost and lower J_c at low magnetic fields, a hybrid approach is a cost-effective option for the high-field magnets. This presentation describes the status and main results of the practical superconductors and high-field accelerator magnets, and discusses the design concepts, technologies, and performance parameters needed beyond 15 T.