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Investigation of evolution in cryogenic requirements for the various magnet development routes towards high field accelerator magnets

In the development for ever stronger-field magnets for particle accelerators there will be coming a major shift from the decades long use of NbTi based conductors to new materials with higher critical temperatures and higher critical fields. The accompanying changes in operating temperature ranges involved, changes in superconducting material properties, possibly using more than one superconductor material (hybrids), use of either insolated or non-insolated cables and increased stored magnetic energy densities, asks for a rethinking of whether the present common cryogenic design choices for accelerator magnets are still appropriate. These cryogenic requirements, specifically in and near the coil-pack, are increasingly important for these new high field/high stored energy magnets to envisage the transition from short R&D type assemblies, generally tested without beam-pipe and not seeing any appreciable heat-load, to accelerator ready assemblies. We would like to address in an as much as possible generic way the evolution in minimum cryogenic requirements posed by the various magnet development routes. The objective is to have the specific cryogenic features considered, although not necessarily already implemented, early during the R&D phase to alleviate bottlenecks should a magnet concept be chosen to evolve to an accelerator-ready design.