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Magnets quench protection

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Three different 16 T dipole magnet options for the Future Circular Collider have been designed within the H2020 EuroCirCol collaboration. Namely, a $\cos\theta$ -type, a block-type, and a common-coil type magnets have been considered. All magnets were designed using the same design criteria related to magnetic field, cable parameter space, mechanical constraints, and quench protection. The quench protection analysis was centralized and done for all options using the same tools and methods. We present here the main steps considered in the magnet quench protection analysis, starting from the requirements defined in the early design phase, the developed tools, performed analysis, and arriving to the final protection schemes.

The designed final protection schemes are based either on traditional quench heaters or on the novel CLIQ-method (Coupling Loss Induced Quench). It will be shown that CLIQ is more efficient in reducing peak temperatures than heaters, and it has been chosen as the baseline protection option. With protection heaters the peak temperatures are higher (approaching the set limit of 350 K when assuming 20 ms detection time and adiabatic hotspot temperature calculation) and it is hard to obtain the required redundancy and safety margin. The future development of heaters is however considered a back-up option.

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