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Circuit layout and protection

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For the FCC-hh study, 100 TeV is the target center of mass energy. This ambitious target can be reached by means of a 16 T dipole field and a 100 km long accelerator circumference. The target performances of dipole magnets, together with the unprecedented size of the accelerator, poses a number of challenges as, among others, machine integration and protection.
In particular, long strings of dipoles need to be formed in order to simplify their powering. This results in large energies stored in the circuits that, in case of quench or equipment failure, have to be extracted safely. One of the main risks is hereby due to the development of high voltages to ground that might irreversibly damage the electrical insulation of circuit components.
In this contribution, we present an optimized layout for the dipole circuits limiting the voltage to ground to acceptable values and addressing other conflicting requirements as, for example, the reduction of overall circuit complexity, ramp-up time, stored energy and discharge time constant. We also show that the designed circuits are compatible with the operation of the Coupling-Loss Induced Quench (CLIQ) system, a magnet protection technology recently developed at CERN.

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