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Effects and criticality of powering failure in the FCC-ee main dipole circuits

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The stored beam energy of FCC-ee will reach 17.5 MJ per beam during the Z-mode operation at 45.6 GeV. Due to the very small beam emittances, the resulting extremely high energy densities pose a significant risk of damage to collider components in case of failures leading to beam impact. This study investigates the criticality of powering failures in the main dipole circuits. The time-dependent effects on the beams are simulated with the Xsuite tracking code. The results expressed in terms of orbit shifts, optics changes, and particle losses show that this failure is highly critical. The beam may experience a horizontal orbit excursion of 10σ within three turns. Interlocking and mitigation strategies have been evaluated and are discussed.

Author: DOMANGE, Delphine (CERN & Universite Libre de Bruxelles (BE))

Presenter: DOMANGE, Delphine (CERN & Universite Libre de Bruxelles (BE))

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