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Damage potential and machine protection criticality of the FCC-ee beams

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The lepton beams of the Future Circular Collider FCC-ee will store 17.5 MJ of energy per beam during Z mode operation. The damage potential of these beams is an essential input for the design of the machine protection system. In this paper, we first report the stored energy and energy density of the FCC-ee beams and compare them with the values for the Large Hadron Collider (LHC) and the High-Luminosity LHC (HL-LHC). We then present the results of energy deposition studies using FLUKA for the generic scenario of a direct beam impact on graphite. Due to the small beam sizes and the distinct shower development, the FCC-ee beams cause peak energy depositions that for Z mode intensities can be comparable to the LHC protons beams. In a last step, the initial hydrodynamic response of the material is simulated using ANSYS Autodyn for a round beam with a corresponding peak energy deposition. The calculated temperature rise, density depletion and pressure development are presented and discussed.

Footnotes

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