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FCC-ee Energy Calibration and Polarization

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The Future Circular electron-positron Collider, FCC-ee, is designed for unprecedented precision for particle physics experiments from the Z-pole to above the top pair threshold. This demands a precise knowledge of the center-of-mass energy (ECM) and collision boosts at all four interaction points and all operation energies. Determining the average beam energies is foreseen using resonant depolarization, with a precision better than 100 keV. This demands transversely polarized non-colliding pilot bunches. While wigglers are foreseen to improve the polarization time, misalignment and field errors can limit the achievable polarization level, and might alter the relationship between the resonant depolarization frequency and the beam energies. Strong synchrotron radiation losses from 40 MeV per turn at the Z-pole and up to 10 GeV per turn at the highest beam energy of 182.5 GeV lead to different ECM and boosts for each interaction point and the beamstrahlung enhances this asymmetry further. Other sources of energy shifts stem from collision offsets and should be controlled. A first evaluation was made in 2019 for the European Strategy. Further studies are ongoing in the framework of the Feasibility Study to be delivered in 2025. First promising results on energy calibration and polarization are presented here.

In-person participation

Yes

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