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Study status on CEPC MDI IR design

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The machine-detector interface (MDI) issues are one of the most complicate and challenging topics at the Circular Electron Positron Collider (CEPC). Comprehensive understandings of the MDI issues are decisive for achieving the optimal overall performance of the accelerator and detector. The CEPC machine will operate at different beam energies, from 45.5 GeV up to 120 GeV, with an instantons luminosity increasing from $5\times10^{34}cm^{-2}s^{-1}$ for the highest energy to $1.9\times10^{36}cm^{-2}s^{-1}$ or even higher for the lowest energy.
A flexible interaction region design will be plausible to allow for the large beam energy range. However, the design has to provide high luminosity that is desirable for physics studies, but keep the radiation backgrounds tolerable to the detectors. This requires careful balance of the requirements from the accelerator and detector sides.
In this talk, the latest design of the CEPC MDI based on the design parameters showed in the CEPC Technical Design Report (TDR) will be presented, covering the following issues:
The design of the beam pipe, which would foresee several constraints: In the central region (z = ±12 cm), it should be placed as close as possible to the interaction point and with a minimal material budget to allow the precise determination of the track impact parameters. But it should still stay far away enough not to interfere with the beam backgrounds. The material and coolants must be carefully chosen based on the heat load calculation. In the forward region, the beam pipe must be made of proper materials to conduct away the deposited heat in the interaction region and shield the detectors from the beam backgrounds.
The estimation and mitigation of beam-induced backgrounds. The detailed simulation covering the main contributions from synchrotron radiation, pair production, and off-momentum beam particles has been performed. The suppering/mitigating schemes have also been studied.
The layout of the CEPC IR and the engineering efforts for several key components like the position of LumiCal/Lumi Monitor, the design of the Final Focusing system, and the Cryostat Chamber.

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