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Impedance Budget and Single-Bunch Instabilities at FCC-ee

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The beam stability in the FCC-ee collider is highly sensitive to impedance sources. Developing a flexible and comprehensive impedance model is crucial for accurately evaluating and mitigating instabilities as machine parameters evolve.
This study investigates the current impedance budget of FCC-ee, with a particular focus on the geometric effect of the collimation system, identifying it as a dominant source of total machine impedance. Its influence on beam dynamics is analysed, with special attention given to the transverse mode-coupling instability (TMCI) threshold, serving as the figure of merit for impedance assessment. By developing a refined impedance model, this work provides valuable insights into instability mitigation and informs operational strategies and critical machine parameter definitions. The results aim to guide future equipment design choices, ensuring robust beam stability and optimal collider performance.

Footnotes

Funding Agency

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Yes

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