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Vibration stability measurement and simulation for the Future Circular Collider studies

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The Future Circular Collider (FCC) study completed the FCC feasibility study on 31 March 2025 and published its report, which examined the technical and financial viability of the FCC at CERN. The first stage of the FCC will be the construction of an electron-positron collider for precision measurements, with a 15-year research programme from the late 2040s (FCC-ee). The beam sizes and emittances involved impose stringent requirements in terms of alignment and nanometric vibration stability. Several sources of vibration can disturb the beam and cause luminosity loss, this paper focuses on the effect of ground vibration. An experimental campaign and numerical analyses, using Finite Element Analysis, were conducted in parallel on a simple Short Straight Section (SSS) demonstrator. The multi-stage characterisation aims to understand how the different elements of the SSS affect the overall stability of the system. The experimental results are compared with the numerical analyses with the aim of gradually refining the simulations to determine more accurately the dynamic stability of the different elements and then extrapolating the results.

Footnotes

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