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Availability-driven design decisions in the future circular electron-positron collider

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The Future Circular Electron-Positron Collider (FCC-ee) is CERN's leading proposal for the next generation of energy-frontier particle accelerators. With 91 km circumference, it is ambitious in both size and technical objectives. So much so that simply the number of components that must be simultaneously operational is a risk to luminosity and physics goals. Availability and reliability are therefore key considerations, driving decisions in this early stage of design. This paper presents the framework by which availability is modelled for this future machine, first by deconstructing contributions from each main constituent system, then by simulating their interconnection in an enhanced Monte Carlo environment. The utility of this model is then showcased by highlighting critical elements in the FCC-ee's current baseline design. Results point to the achieved integrated luminosity, the number of human maintenance interventions each week and the number of repaired components in various subsystems. These cost-influencing factors demonstrate the need for timely consideration of reliability concepts in a machine of this size, for which various mitigating R&D opportunities are proposed.

Footnotes

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