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Xsuite: A Modular Accelerator Simulation Framework

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Xsuite is a recent Python framework for accelerator physics simulations developed at CERN. Since its inception in 2021, it has progressively supplanted legacy simulation tools such as SixTrack, sixtracklib, PyHEADTAIL, and COMBI. It consists of distinct, interconnected Python modules—Xobjects, Xdeps, Xtrack, Xpart, Xfields, Xcoll, and Xwakes—and seamlessly interfaces with other accelerator-specific and general-purpose scientific Python tools. This design enables rigorous symplectic treatments of particle dynamics and incorporates sophisticated models to simulate synchrotron radiation, beam impedances, space charge and beam-beam effects, electron-cloud interactions, and collimation processes. For the latter, specific interfaces to particle-matter interaction libraries such as BDSIM and Geant4 are implemented. Targeting high-performance computing, Xsuite supports both CPU and GPU architectures, significantly enhancing computational efficiency and enabling accelerated simulation workflows.

Secondary track

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