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Next-generation interaction point simulations for linear lepton colliders

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The International Linear Collider (ILC) is among the most mature designs for a next-generation linear electron-positron collider. Plasma-based accelerators have also been proposed to reach the 10 TeV COM level further in the future. A key challenge in these types of machines is preserving the luminosity at the target value, mitigating the potentially detrimental effects of disruption, beamstrahlung, and background generation. This is why in-depth beam crossing studies are required to provide a comprehensive description of the physics at the interaction point. We present the exascale open-source code WarpX as a next-generation tool for beam-beam investigations. WarpX guarantees strong performance, portability (different operative systems, multi-CPU/GPU), flexibility (many options, algorithms, diagnostics, etc.), with up-to-date documentation and consistent maintenance within a large, active and multi-disciplinary community. We present benchmarks against established codes like GUINEA-PIG and CAIN, and show first results of simulation campaigns for the ILC, C³, HALHF, and plasma-based colliders.

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