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ABEL: A Start-to-End Simulation and Optimisation Framework for Plasma-Based Accelerators and Colliders

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The Adaptable Beginning-to-End Linac (ABEL) simulation framework offers a comprehensive solution for simulating and optimising plasma-based accelerators and colliders. ABEL's modular, Python-based design unites diverse, specialised codes such as HiPACE++, Wake-T, ELEGANT, GUINEA-PIG, CLICopti and ImpactX under a single framework, enabling seamless transitions when simulating beamlines consisting of different components. Simplified models for transverse instabilities, radiation reactions, and ion motion built into ABEL also further allows for flexibility in balancing between simulation fidelity and computational fidelity. ABEL further integrates advanced diagnostic tools and robust Bayesian optimisation techniques to enhance machine design, performance evaluation and allow for global optimisation of the full programme cost.

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