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ABEL: The adaptable beginning-to-end linac simulation framework

Tuesday 3 June 2025 16:00 (2 hours)

We introduce ABEL, the Adaptable Beginning-to-End Linac simulation framework developed for agile design studies of plasma-based accelerators and colliders. ABEL's modular architecture allows users to simulate particle acceleration across various beamline components*. The framework supports specialised codes such as HiPACE++, Wake-T, ELEGANT, GUINEA-PIG and CLICopti, which facilitate precise modelling of complex machine components. Key features include simplified models for addressing transverse instabilities, radiation reactions, and ion motion, alongside comprehensive diagnostics and optimisation capabilities. Our simulation studies focus on the HALHF plasma linac, examining tolerances for drive beam jitter, including effects of self-correction mechanisms. Simulation results demonstrate ABEL's ability to model emittance growth under transverse instability and ion motion, highlighting the framework's adaptability in balancing simulation fidelity with computational efficiency. The findings point towards ABEL's potential for advancing compact accelerator designs and contribute to the broader goals of enhancing control and precision in plasma-based acceleration.

Footnotes

- Such as plasma acceleration stages, interstage optics, RF-accelerators, damping rings, combiner rings, beam delivery system and interaction point.

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Europe

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