

High-quality polarised electron bunches from colliding pulse injection

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Highly polarised, high current electron bunches from compact laser-plasma accelerators are sought after for numerous applications. However, current proposals to produce these beams suffer from intrinsic limitations to the reproducibility, charge, beam shape and final polarisation degree. We propose colliding pulse injection as a technique for the generation of highly polarised electron bunches from pre-polarised plasma targets. Using particle-in-cell simulations, we show that colliding pulse injection enables accurate control of the spin-polarisation during the trapping of electrons, enabling high-current electron bunches with high degrees of polarisation to be generated. Bayesian optimisation is employed to optimise the multi-dimensional parameter space of colliding pulse injection, demonstrating the generation of highly polarised, high-quality electron bunches employing 100-TW class laser technology.

Primary authors: Dr BOHLEN, Simon (DESY); Dr GONG, Zheng (MaxPlanck-Institut für Kernphysik); Mr QUIN, Michael (Max Planck-Institut für Kernphysik); TAMBURINI, Matteo (MaxPlanck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany); OSTERHOFF, Jens (Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany and Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany); PODER, Kristjan (DESY)

Presenter: PODER, Kristjan (DESY)

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