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Two-Pulse Ionisation Injection with simultaneous space-time focused pulses

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Controlling the injection of electrons into laser wakefields will be important for improving the quality of the accelerated bunches, and reducing their shot-to-shot jitter. This is particularly challenging for accelerators operating in the quasi-linear regime since the fields are weaker. We recently proposed the two-pulse ionization injection (2PII) scheme in which electrons ionized from a dopant species by a tightly focused trailing pulse are trapped in the quasi-linear wake driven by a leading pulse. Here we build on that work by considering simultaneous space-time focusing (SSTF) of the injection pulse; this provides tighter localization of the injection, leading to reduced energy spread and reduced emittance. We present PIC simulations of 2PII with SSTF pulses and explore the extent to which this approach can improve the electron bunch properties and control the spectrum and brilliance of betatron X-rays they generate.

Summary

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