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Machine learning for laser pulse shaping

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The temporal profile of the electron bunch is of critical importance in accelerator areas such as free-electron lasers and novel acceleration. In FELs, it strongly influences factors including efficiency and the profile of the photon pulse generated for user experiments, while in novel acceleration techniques it contributes to enhanced interaction of the witness beam with the driving electric field. Work is in progress at the CLARA facility at Daresbury Laboratory on temporal shaping of the ultraviolet photoinjector laser, using a fused-silica acousto-optic modulator. Generating a user-defined (programmable) time-domain target profile requires finding the corresponding spectral phase configuration of the shaper; this is a non-trivial problem for complex pulse shapes. Using a physically informed machine learning model, we demonstrate accurate and rapid shaping of the photo-injector laser to a wide range of arbitrary target temporal intensity profiles on the CLARA PI laser. Additionally, we discuss the utility of this expanded range of laser pulse shapes to potential applications in FELs and novel acceleration.

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Footnotes

I have read and accept the Privacy Policy Statement

Yes

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