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Towards Underdense Photocathode Plasma Wakefield Acceleration at FACET

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A comprehensively synchronized beam-laser-plasma photocathode setup has been developed at FACET within the E210 program. Spatial and temporal alignment allow to carry through proof-of-concept experiments, aiming at demonstrating the feasibility of underdense photocathode "Trojan Horse" plasma wakefield acceleration. Multiple laser pulses are synchronized with the 20 GeV electron driver beam based on two electro optical sampling diagnostics, and are independently tunable to accomodate maximum flexibility. Important milestones made towards first realization of the scheme are presented. The scheme promises a route towards production of electron bunches with unprecedented electron bunch brightness, exceeding those of existing facilities by orders of magnitude.

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