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LCODE 3D: a free quasistatic plasma wakefield acceleration code

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LCODE, a freely-distributed parallel quasistatic 2D3V code, has helped pushing plasma wakefield acceleration forward for decades. It empowers researchers with a numerically efficient simulation tool excelling at long-term propagation of ultrarelativistic particle beams in plasmas. While its performance-focused principles, techniques and tricks make it possible to simulate frontier plasma wakefield acceleration experiments in just days or hours of CPU time and megabytes of RAM, there is a number of 3D-specific effects like side-injection, filamentation or hosing instability that cannot be properly taken into account with a 2D simulation window.

A three-dimensional rewrite of LCODE is in the works, catering to the emergent need of proton-driven plasma wakefield acceleration to conduct 3D simulations. Building up on previous LCODE expertise, it aims to employ the same resource-frugal approach and techniques to marry simple and straightforward underlying models and algorithms with high numerical stability while striving to minimize the decrease of performance resulting from transitioning to 3D.

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