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A parametric approach to plasma wakefield acceleration at CLARA

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The Compact Linear Accelerator for Research and Applications (CLARA) at Daresbury Laboratory in the UK is a state-of-the-art facility that provides mid-energy range, high-brightness electron beams for exploring innovative concepts in accelerator science and technology. An exciting upcoming development is the integration of the Full Energy Beam Exploitation (FEBE) beamline, specifically designed for applications requiring the full beam energy of 250 MeV at CLARA. This integration will transform CLARA into an advanced testbed for proof-of-principle novel acceleration applications. Notably, a plasma wakefield acceleration (PWFA) experiment is potentially feasible with the CLARA FEBE. In this context, we present particle-in-cell simulation studies to explore a potential two-beam PWFA experiment at CLARA FEBE. A parametric approach will be employed to systematically determine the initial parameters of the plasma, driver, and witness beams by varying these parameters methodically. The study aims to double the energy of the witness beam while maintaining its low energy spread. We will identify the acceleration regime and the parameters that best suit a PWFA experiment at CLARA.

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