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Preparation for Realisation of External Electron Injection for AWAKE Run 2b

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The Advanced Wakefield Experiment (AWAKE) aims to accelerate electrons to particle physics relevant energies using self-modulated proton bunches as drivers in a single plasma. AWAKE is now in its Run 2b (2023-2024), where the goal is to stabilise wakefields by using a plasma density step. Experimental demonstrations require probing of the longitudinal wakefields by externally injected electron bunches. To optimise charge capture in the wakefields, the electron beam density should be maximised at the site of injection z_e . This is achieved by setting the beam waist at z_e . Since no diagnostics are currently available at these locations, waist beam sizes are extrapolated from measurements upstream. The qualitative and quantitative agreement obtained between measured and simulated transverse electron beam sizes, at locations where these can be measured, demonstrates good understanding of the beam line optics and provides confidence in the extrapolated beam sizes at waist locations, where these cannot be measured. This information can then be used in the experiment to maximise the beam density at the site of injection.

Footnotes

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