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Parametric study of high-charge bunch generation in an L-band photoinjector

The Argonne Wakefield Accelerator's main beamline – the drive-beam beamline – utilizes a $1+\frac{1}{2}$-cell radiofrequency photoinjector at 1.3 GHz to produce high-charge bunches. This contribution discusses an experiment to investigate photoemission from the RF gun over a wide range of operation parameters spanning different emission regimes. It especially demonstrates the generation of a >50-nC bunches using a ~ 300-fs UV laser pulse corresponding to an initial multi-kA peak current. The measurements are compared with numerical simulations performed with the ASTRA beam dynamics program. The transport and further acceleration of these bunches are investigated via numerical simulations.

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