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Studies of photoemission in the high-field regime in an X-band photoemission RF gun

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A program is underway at the Argonne Wakefield Accelerator (AWA) facility, in collaboration with Euclid Techlabs and Northern Illinois University (NIU), to develop a GV/m-scale photocathode gun, to produce bright electron bunches. The novel X-band (11.7 GHz) photoemission gun (Xgun) is powered by high-power, short RF pulses (9 ns) generated by the AWA drive beam in a wakefield structure. In the first series of experiments, the Xgun demonstrated peak fields of ~ 400 MV/m on the photocathode surface. As a first step towards achieving a complete understanding of the Xgun's performance in the high-field regime, we studied the photoemission mechanism by measuring the quantum efficiency (QE) and thermal emittance across a large range of operating fields on the photocathode surface from 60 MV/m to values exceeding 300 MV/m. In this work, we will present the results of our experimental measurements and simulation studies on examining photoemission at high fields on the photocathode surface.

Footnotes

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