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Generation of Patterned Electron Beams with Microlens Arrays

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Microlens arrays are fly-eye type light condensers that are commonly used to improve the uniformity of light beams. A common problem of the photocathode in electron accelerators is distortion of the laser spot due to non ideal conditions at all stages of the amplification. Such a laser spot at the cathode may produce asymmetric charged beams that will result in degradation of the beam quality due to space charge at early stages of acceleration and fail to optimally utilize the cathode surface. In this talk we discuss the possibility of using microlens arrays to dramatically improve the transverse uniformity of the drive laser pulse on UV photocathodes at both the Argonne Wakefield Accelerator (AWA) and the Fermilab Accelerator Science & Technology (FAST) facility. In particular, we discuss the experimental characterization of the homogeneity and periodic patterns formation at the photocathode. Finally, we compare the experimental results with the paraxial analysis, ray tracing and wavefront propagation software.

Primary authors: Mr HALAVANAU, Alex Halavanau (Northern Illinois University); Mr HALAVANAU, Aliaksei (APC); PIOT, Philippe (FNAL)

Co-authors: EDSTROM, Chip (AD/APC/FAST); SANTUCCI, Jamie (FNAL); RUAN, Jinhao (Fermilab)

Presenters: Mr HALAVANAU, Alex Halavanau (Northern Illinois University); Mr HALAVANAU, Aliaksei (APC)

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