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Measurement of directional muon beams generated at the Berkeley Lab Laser Accelerator

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We report the detection of directional muon beams generated by a compact
petawatt-class laser-plasma wakefield accelerator (LPA). Multi-GeV electron bunches are generated and accelerated in a 30 cm plasma and subsequently converted into high-flux, directional muon beams through pair production in a high-Z target. Muons are unambiguously identified and characterized using a scintillator-based coincidence detection scheme. The results are benchmarked against a detailed Geant4 model of the experimental setup, showing excellent agreement with the data and indicating a production rate that significantly surpasses the cosmic muon background radiation. The demonstration of high-yield, directional muon beam production based on a compact laser-plasma wakefield accelerator paves the way for the development of portable muon
imaging applications with substantially reduced exposure times.

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