



Contribution ID: 135

Type: **Invited Talk**

## All-optical source size and emittance measurements of laser-accelerated electron beams

*Thursday, 17 April 2025 10:06 (33 minutes)*

Recent developments in ultra-low emittance electron beam generation offer compact, high-quality particle sources for future high-energy physics and free-electron laser applications. Measuring such excellent emittances poses a significant challenge.

Here we present a new, laser-based technique which modulates the electron phase-space ponderomotively, achieving sub-0.1 mm mrad emittance resolution. We report the first experimental validation of this approach using a laser wakefield accelerator. Our results are in agreement with emittance and source size values of prior studies using different methods such as quadrupole scans. Additionally, we demonstrate that the “laser-grating” method provides upper limits on emittance and source size, even under conditions of low signal-to-noise ratio and uncertainties in laser-grating parameters.

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**Session Classification:** Plenary Session