



Contribution ID: 167

Type: **not specified**

Performance envelope of laser wakefield accelerators

Tuesday, 23 July 2024 15:10 (20 minutes)

Laser wakefield accelerators (LWFA) have long promised to revolutionize particle acceleration by shrinking facility size and cost by orders of magnitude. Despite twenty years of experiments however, we do not understand the performance envelope of LWFAs. Experiments and simulations demonstrate a wide range of possible operating points, ranging from high-charge beams to high-energy beams. Models tend to provide rough estimates of electron beam energy only and a rough guide for design only in this parameter. To address this gap, we analyze a large set of the published experimental data to estimate a general performance envelope for LWFAs. We find that laser wakefield accelerators exhibit somewhat better scaling of overall input-to-output energy efficiency than radio-frequency accelerators. To the extent possible, we also compare experimental choices and outcomes to models in the literature.

Working group

WG1 : Laser-driven plasma wakefield acceleration

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Session Classification: WG1