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Gas jet characterization methods for laser plasma wakefield accelerators

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The dynamics of laser wakefield acceleration processes are strongly coupled to the underlying plasma density profile, which, in turn, directly scales with the target's initial gas density distribution. Hence, a precise and reliable characterization of gas targets is an indispensable prerequisite for optimizing the performance of plasma-based accelerators. We present a comparative study of gas target characterization methods employing light sources across different wavelength regimes. Several de Laval nozzles generating gas jets with densities ranging from 10^17 to 10^19 cm^-3 were investigated. By integrating diagnostics across multiple regimes, we aim to develop a comprehensive understanding of important gas target characteristics, facilitating improved control over accelerating and matching conditions in plasma-based accelerator experiments. Additionally, further ideas for improved data collection and analysis are discussed.

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