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Continuous-Flow Plasma Target for LWFA: Concept Towards High Repetition Rates

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Stable and high-repetition operation of a plasma-target for Laser Wakefield Acceleration is a key element for reliable, accessible and reproducible experiments. Many LWFA experiments rely on targets, which operate with short bursts of gas in order to reduce gas load within the system to a minimum. However, even in burst mode it requires considerable time to reduce the pressure to a level low enough for the next laser-shot, which is one of the most limiting constraints in electron repetition rate. In contrast to pulsed operation, this talk will show a concept to be implemented at the LUX-Beamline, operated by University of Hamburg and DESY, that allows for continuous flow operation of a capillary-type target. This enables the highest electron repetition rates, only limited by the repetition rate of the driver laser. Additionally, we expect continuous gas flow operation to reduce possible error sources from pressure fluctuations inside the target as well as timing jitter issues between laser pulse and gas pulse, stemming from non-reproducible gas valve dynamics. Our concept features a differential pumping setup, specially designed for laser applications, and allows for direct online pressure measurement inside the target, which yields absolutely calibrated values.

Primary author: Mr DELBOS, Niels (University of Hamburg / Center for Free Electron Laser Science)

Co-authors: MAIER, Andreas (CFEL/UHH); Mr WERLE, Christian (University of Hamburg); Mr KOCON, Dariusz (University of Hamburg, ELI); Mr MESSNER, Philipp (University of Hamburg / Center for Free Electron Laser Science)

Presenter: Mr DELBOS, Niels (University of Hamburg / Center for Free Electron Laser Science)

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