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Development and characterization of plasma targets for controlled injection of electrons into laser-driven wakefields TOBIAS KLEINWAECHTER, LARS GOLDBERG, CHARLOTTE PALMER, LUCAS SCHAPER, University of Hamburg, JAN-PATRICK SCHWINKENDORF, Deutsches Elektronen-Synchrotron DESY and University of Hamburg, JENS OSTERHOFF, University of Hamburg — Laser-driven wakefield acceleration within capillary discharge waveguides has been used to generate high-quality electron bunches with GeV-scale energies. However, owing to fluctuations in laser and plasma conditions in combination with a difficult to control self-injection mechanism in the non-linear wakefield regime these bunches are often not reproducible and can feature large energy spreads. Specialized plasma targets with tailored density profiles offer the possibility to overcome these issues by controlling the injection and acceleration processes. This requires precise manipulation of the longitudinal density profile. Therefore our target concept is based on a capillary structure with multiple gas in- and outlets. Potential target designs are simulated using the fluid code OpenFOAM and those meeting the specified criteria are fabricated using femtosecond-laser machining of structures into sapphire plates. Density profiles are measured over a range of inlet pressures utilizing gas-density profilometry via Raman scattering and pressure calibration with longitudinal interferometry. In combination these allow absolute density mapping. Here we report the preliminary results.

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