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First plasma acceleration experiments at PITZ

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One key aspect of the plasma acceleration experiment which is prepared by the AWAKE collaboration at CERN is the self-modulation of a long (compared to the plasma wavelength) particle beam in a plasma. To study this effect in detail an experiment was conceptualized at the Photo-Injector Test Facility at DESY, Zeuthen site (PITZ) to inject a 6 mm long electron beam into a lithium plasma with a density of 10^{15} cm⁻³.

In this contribution we report about first experiments with the plasma cell which was inserted into the PITZ beam line. The cell is prepared with lithium and argon buffer gas, then heated up to 700C to achieve a lithium atmosphere with the necessary density. The lithium is ionized with an ArF laser (193 nm wavelength) via sideports, creating a plasma channel with a length of 10 cm. The 22 MeV electron beam available at PITZ is focused tightly into the plasma, then guided from there to the diagnostics elements. The reaction of the electron beam in the plasma is recorded and is compared to the case when the oven heating and ionization laser is switched off.

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