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Excitation of beam driven plasma waves in a hybrid L|PWFA

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Recent progress in laser wakefield acceleration (LWFA) has demonstrated the generation of high peak current electron beams with improved shot to shot stability [1]. Using high-current electron beams from a LWFA as drivers of a beam-driven plasma wakefield accelerator (PWFA) has been proposed as a beam energy and brightness transformer [2], aiming to fulfill the demanding quality requirements for applications such as FELs. It has been demonstrated experimentally that electron beams from LWFA can actually drive plasma wakefields by themselves [3]. In order to further study the generation of plasma waves in the PWFA stage a sub-10 fs probe pulse was deployed and installed at HZDR. We observed beam driven plasma waves at different plasma densities, showing the capability of the LWFA beam to drive plasma wakefields in the self-ionizing regime. Furthermore we observed a correlation between the driver beam charge and the shape of the plasma wave. This enables us to find an optimum parameter set towards the experimental demonstration of the hybrid LPWFA.

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