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FLASHForward X-1: High-brightness electron beams from a plasma cathode

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The beam-driven FLASHForward experiment 1 (X-1) aims at the generation of high-brightness electron bunches for photon science applications in several centimeters of plasma, with the plasma acting both as a cathode and accelerator.
The 1 GeV electron-bunch with a peak current of 2.5 kA and a synchronized TW-laser system makes FLASH-Forward a unique facility[1] to study controlled electron-injection into plasma wakes.
With density downramp injection, witness bunches of ~1 kA peak current at emittances well below 1 µm are achievable[2]. The sharp plasma density gradients are produced by means of controlled gas flow[3] or by localized laser ionization transverse to the electron-beam orbit[4].
Precise laser-to-electron-beam synchronization enables controlled injection as e.g. the Trojan Horse scheme[5], which is predicted to support sub-0.1-µm-emittance witness bunches.
experimental installation status, planning, and prospects of the FLASHForward X-1 experiments are presented.
[1]A. Aschikhin et al. NIM A,2016
[2]A. Martinez de la Ossa et al., submitted, 2017
[3]L. Schaper et al. NIM A, 2014
[4]G. Wittig et al. PRSTAB, 2015
[5]B. Hidding et al. PRL, 2012

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