

Electron injection into proton driven plasma wake-field for the AWAKE experiment at CERN

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The AWAKE project at CERN is a proposed proof-of-principle experiment on the acceleration of electrons in a plasma wave excited by high-energy proton bunch. The 400 GeV proton bunch extracted from the SPS accelerator will pass through 10 m long plasma section. Plasma will be produced from Rb gas via photo-ionization by short laser pulse co-propagating with the proton bunch. In the first half of the plasma section proton beam will be self-modulated due to development of transverse two-stream instability. 10-20 MeV electrons should be side-injected into the developed plasma wave in the middle of this plasma section. Electron injection scheme assumes co-propagation of electron beam at a distance of ~1 cm from proton and laser pulse in the neutral Rb gas. In the middle of plasma section a superimposed magnetic field directs electrons towards the plasma wave. In this study we present the details of electron beam transport through the neutral gas as well as side-injection simulation. Some fraction of electron beam which is not captured by the plasma wave could be observed in the downstream low-energy electron spectrometer.

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