



Contribution ID: 46

Type: poster

Simulation Study of a LWFA-Based Electron Injector for AWAKE Run II

Monday, 25 September 2017 19:30 (1 hour)

The AWAKE experiment [1] is a proof-of-principle proton driven plasma accelerator at CERN. Using a 400 GeV SPS proton beam GV/m wakefields are excited in a 10 m plasma to accelerate an injected electron bunch, derived from an adjacent S-band RF electron gun and booster. Future experiments will demonstrate electron acceleration while preserving the beam quality. This places new requirements on the electron injector that are challenging to meet with the current S-band RF system. A laser wakefield accelerator [2] (LWFA) has therefore been proposed to produce fs duration electron bunches and provide sufficient beam current required to load the proton-driven wakefields [3] from a compact design. We present 2D/3D PIC simulations to evaluate potential LWFA schemes that satisfy the required electron beam parameters with minimal shot-to-shot fluctuations. In addition, challenges to its implementation, particularly in beam transport needed to optimize bunch parameters prior to injection, are discussed.

Please see the comments section for details of the references

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Session Classification: Wine and Poster Session 1(WG1-WG2-WG3-WG8)

Track Classification: WG1 - Electron Beams from Plasmas