



Contribution ID: 222

Type: talk

Acceleration of electrons in the plasma wakefield of a self-modulated proton bunch

Wednesday, 18 September 2019 09:40 (30 minutes)

AWAKE is a proof-of-principle experiment to study proton driven plasma wakefield acceleration at CERN. Highly relativistic proton bunches (e.g. available at CERN) carry large amounts of energy (>20 kJ). They have the potential to excite \sim GV/m plasma wakefields that can accelerate a witness bunch to TeV energies in a single plasma stage. The proton bunch length is on the order of 10 cm; much longer than the plasma electron wavelength at the densities needed to achieve GV/m field amplitudes. Thus, AWAKE relies on the transverse seeded self-modulation to modulate the long bunch into a train of microbunches. This microbunch train then resonantly drives high amplitude wakefields. In this contribution, we discuss the experimental results of AWAKE Run 1 (2016-2018) including: acceleration of externally injected 18.6 MeV electrons to GeV energies in 10m of plasma.

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Session Classification: Plenary Session 5

Track Classification: Invited Plenary Talk