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Betatron radiation diagnostic for AWAKE Run 2

Monday, September 16, 2019 7:00 PM (1 hour)

Proof-of-concept experiments in AWAKE Run 1 have demonstrated electron acceleration in a proton-driven wakefield¹. A high momentum proton beam can drive a wakefield over long distances and overcome some limitations of lepton-driven schemes, which are susceptible to energy depletion. AWAKE Run 2 aims to preserve the beam quality of an injected electron beam throughout acceleration, and consequently a new diagnostic to measure the electron beam emittance after the plasma cell is required. Betatron radiation spectroscopy is a valuable diagnostic tool for the laser-plasma accelerator (LPA) community, and has been used to reconstruct the trace-space of an LPA-generated electron beam². We propose implementing a similar system at the AWAKE experiment. The expected betatron emission from witness electrons at AWAKE is fully characterised using 3D quasi-static PIC simulations with the code QV3D³, and a diagnostic system able to measure such a betatron spectrum is described. Initial measurements and challenges related to the proton driver are discussed.

¹Adli, E. et al. Nature 561, 363-367 (2018).

²Curcio, A. et al. PRAB 20, 012801 (2017).

³Pukhov A. CERN Yellow Rep. 1, 181 (2016).

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