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Influence of proton bunch and plasma parameters on the AWAKE experiment MARIANA MOREIRA, JORGE VIEIRA, Inst Superior Tecnico (IST), PATRIC MUGGLI, Max-Planck Institute for Physics — The Proton Driven Plasma Wakefield Acceleration Experiment (AWAKE) at CERN will test the concept underlying plasma wakefield acceleration using long proton beams that undergo the self-modulation instability. The effectiveness of the experiment hinges on the successful and predictable development of this instability, which fragments the initial proton bunch into smaller beamlets with lengths of the order of the plasma wavelength. Since the initial parameters of the experiment inevitably vary from event to event, this work will aim to understand the correlation between these variations and the resulting wakefield. Using both theoretical models and numerical particle-in-cell simulations, the influence of variations in initial bunch charge, bunch dimensions, bunch energy and plasma density profile on the excited accelerating gradients and on the final energies reached by the witness particles will be investigated. In addition, further options in the experiment setup will be explored with the aim of optimizing the results.

Mariana Moreira
Inst Superior Tecnico (IST)

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