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Architect: a 2D hybrid kinetic-fluid code for Plasma Wake Field Acceleration

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Plasma Wakefield Acceleration (PWFA) needs efficient simulation tools to assess possible scenarios of experimental interest. While fluid models provide quick tools to understand the basic mechanisms, kinetic methods as the Particle in Cell (PIC) provide the most general and widely used self consistent tools to study the interaction between the injected beam and the plasma. Nonetheless, fully kinetic codes require time-consuming simulations. The need for fast running simulation tools to perform online analysis of PWFA experiments leads to studies on the validity of reduced models.

To address these necessities, a 2D hybrid fluid-kinetic code for PWFA is presented: Architect. The beam particles are treated in a kinetic PIC-like mode, while the plasma wake is treated as a fluid. The reduced number of particles involved in the hybrid model significantly reduces the number of operations required in a simulation with respect of full PIC codes with the same number of dimensions.

The accuracy and validity of the hybrid scheme is assessed against 3D full PIC code ALaDyn simulations, the drastic run time reduction will be highlighted.

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