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hybrid-code and PIC-code simulations for PWFA at SPARC_LAB

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We present a possible working point for the Sparc_Lab LNF facility that preserve bunch quality: witness is positioned and shaped so to preserve, over the entire acceleration length, both emittance and energy spread. This configuration is characterised by a 200pC driver and a 20pC follower witness. The one driver plus one witness is extended to a COMB (train of bunches) configuration: 3 drivers plus a witness. Bunch characteristics are taken from recent Sparc_Lab experimental results.

To obtain the effective working point we used, and we currently use, a combination of two codes: Architect, an hybrid fast-running code, and ALaDyn a full PIC-code. Both tools are necessary to fully understand the underlying physics and to quickly asses feasible working points.

Architect is an hybrid code: bunches are treated kinetically while the background plasma is model as a cold fluid. The following approach allow to greatly reduce run time, a few hours, without loss of generality. We wish to point out that Architect is designed not to give qualitative solutions; Architect well predicts solutions up to the weakly-non-linear regimes, well reproducing the bubble-wake profile.

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