ID contributo: **378** Tipo: **Invited talk**

Modeling a novel laser-driven acceleration scheme using particle-in-cell simulations on exascale-class supercomputers

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Laser WakeField Acceleration (LWFA) can accelerate ultra-short electron bunches up to very high energies (from hundreds of MeV to several GeV). However, LWFA usually does not provide enough charge for most of the foreseen applications, especially if high beam quality and high energies are also required.
Recently, we have devised a novel injection scheme consisting of a solid target coupled to a gas jet to accelerate substantially more charge than conventional injection schemes, while preserving at the same time the quality of the beam. In 2022 we validated this concept with proof-of-principle experiments at the LOA (France), and with a large-scale Particle-In-Cell simulation campaign, carried out with the open-source WarpX code[1,2]. In this contribution, we will summarize the insights gained from these simulations, carried out on the most powerful supercomputers in the world, including Summit (OLCF, #5 in the Top500), Fugaku (Riken, #2 in the Top500), and Frontier (OLCF, #1 in the Top500). A work describing the technical challenges that we addressed to make these simulations possible was awarded the Gordon Bell prize in 2022 [3].

1. https://ecp-warpx.github.io/
2. A.Myers et al. Parallel Computing 2021
3. L.Fedeli et al. 2022 SC22 IEEE Computer Society, 2022

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