MATTER AND TECHNOLOGIES

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Hybrid plasma accelerators - LWFA-PWFA simulations with PIConGPU

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Utilizing laser-wakefield accelerated (LWFA) electrons to drive a plasma-wakefield accelerator (PWFA) holds great promise for realizing centimeter-scale electron accelerators providing ultra-high brightness beams. Recent experiments at HZDR could demonstrate for the first time such an electron acceleration in a nonlinear PWFA plasma wakefield using this compact setup.

On this poster, we show recent results of the accompanying simulation campaign performed with the 3D3V particle-in-cell code PIConGPU. These simulations model the geometry, density distributions, laser modes, and gas dopings as determined in the experiments. The simulation conditions resemble the experiment to a very high degree and thus provide precise comparability between experiment and simulation. Additionally, the wealth of information provided by the in-situ data analysis of PIConGPU provides insight into the plasma dynamic, otherwise inaccessible in experiments. Algorithmic and computational challenges essential for the numerical stability of these long-duration simulations will be presented as well.

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