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Simulation study on the impact of a single plasma accelerator stage to existing free-electron lasers.

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Free-electron lasers (FELs) are powerful tools for studying matter at the atomic level and its dynamics on the femtosecond scale. Plasma accelerators hold the promise of drastically reducing the size and costs of future accelerators, which could also help make FELs more widely applicable and perhaps even viable for industry. While a truly compact, fully plasma-based FEL still faces several challenges to reach the capabilities of today' s X-ray FELs, upgrading an existing FEL with a single-stage plasma-based energy booster appears a realistic goal within this decade. Such a first application of a plasma accelerator will drive advances to strengthen the credibility of plasma acceleration as a reliable technology for future compact particle accelerators, ultimately uncovering the necessary developmental steps for maturing it as a standard technology. In this contribution, we discuss the potential scientific impact of adding a plasma booster to different existing FEL facilities, based on simulations.

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