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Plasma-wakefield acceleration at high repetition rates

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The GV/m accelerating gradients inherent to plasma accelerators may hold the key to unlocking cost-effective accelerators, facilitating the acceleration of particle bunches to higher energies over shorter distances. However, in order to reach the luminosity and brilliance demands of high-energy physicists and photon scientists, plasma accelerators of the future must be capable of accelerating thousands of high-intensity bunches per second—many orders of magnitude more than the current state of the art. The first step towards answering whether or not plasma accelerators can meet this lofty goal was recently made by ascertaining that the minimum possible separation between two consecutive acceleration events is defined by the fundamental physics of long-term plasma evolution. The many-nanosecond-level recovery time measured at FLASHForward establishes the in-principle attainability of megahertz rates of acceleration in plasma. In order to reach this upper limit with a practical accelerator, however, further scientific results as well as robust developments in plasma-source technology will be required. This presentation will report on the most recent results in the field with an outlook towards reaching a practical solution in the future.

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