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# Temperature diagnostics for high-repetition-rate plasma accelerator sources

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Electron-bunch-driven plasma-wakefield accelerators promise to revolutionize particle acceleration by providing compact and cost-effective energy boosters for electron linacs which could, for example, significantly enhance the photon energies produced by free-electron lasers. The FLASHForward facility at DESY has made substantial progress, demonstrating that accelerated electron bunches can maintain their charge, energy spread, and emittance during plasma acceleration. A major challenge remains in achieving high-repetition-rate operation, as is common in radio-frequency accelerators.

To be competitive with proposed linear collider schemes and currently operating FELs, average repetition rates on the order of 10 kHz are required. Therefore, identical plasma acceleration events must take place at high frequencies over a long period of time. One of the important challenges is to deal with the high heat load placed on the plasma cell by the plasma formation process and the driving beam, which are similar in terms of power deposition at FLASHForward. In this contribution we report on recent efforts to characterize the long-term heating effects arising in a discharge plasma source operated at repetition rates up to 1 kHz. We will present measurements of the time evolution of the discharge plasma source and discuss the implications of these results for sustained high-repetition-rate operation.

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