Extended Interaction Length Laser-Driven Acceleration in a Tunable Dielectric Structure

Monday 18 March 2024 12:30 (30 minutes)

The development of long, tunable structures is critical to increasing energy gain in laser-driven dielectric accelerators (DLAs). Here we combine pulse-front-tilt illumination with slab-geometry structures assembled by precisely aligning off-the-shelf 4~mm long transmission gratings to achieve up to 200 keV energy modulation for 6 MeV injected electrons. The effective interaction length is longer than 1~mm, limited by dephasing of the accelerated particles in the structure. The piezo-based independent mounting system for the gratings allows tuning of the gap and field distribution inside the structure.

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Session Classification: DLA - Experiments