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Considerations for Energy Scaling of Dielectric Laser Accelerators

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Dielectric Laser-driven Acceleration (DLA) refers to the acceleration of particles inside a vacuum channel within a dielectric structure powered by near infrared lasers. Recent demontrations of accelerating gradients approaching 1 GeV/m, improvements in energy gain, numerically optimized structure designs, and development of a variety of auxilliary laser-driven concepts for focusing, steering, and beam position monitoring, have set the stage for developing integrated laser-driven accelerator systems. However, the shift from microwave to optical wavelengths results in narrow beam apertures and tight tolerances on phase control, which pose unique challenges for scaling the approach to MeV, GeV, and higher energies of interest for first applications. We discuss some of these challenges as well as possible solutions and mitigations, review recent progress in this area, and present plans for future experiments.

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