



Contribution ID: 231

Type: talk

Staging, focusing and microbunching in dielectric laser accelerators

Thursday, September 28, 2017 4:00 PM (20 minutes)

Dielectric laser accelerators (DLAs) form a class of novel accelerators that potentially enables a variety of exciting applications, ranging from MeV handheld electron sources to table-top coherent x-ray sources. Recently, DLAs have demonstrated acceleration gradients approaching 1 GeV/m with a variety of dielectric materials, laser wavelengths, and nanostructure geometries. Realizing the above applications, however, requires extending the interaction length between electrons and the laser induced fields. Furthermore, the restrictive longitudinal and transverse acceptance of the nanostructures necessitates microbunching and focusing the electron beam, preferably on a similarly-miniaturized scale. Here, we report on experimental demonstration of DLA-based staging and focusing and on efforts to realize a DLA-based microbunching scheme. Approaches for addressing these challenges are discussed.

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Session Classification: WG3_Parallel

Track Classification: WG3 - Electron Beams from Electromagnetic Structures, Including Dielectric and Laser-driven Structures