



Contribution ID: 72

Type: **Tutorial**

Plasma based devices for acceleration, transport and diagnostics of high brightness electron beams

Friday, 5 October 2018 11:00 (45 minutes)

In recent years, the need for much higher field strength acceleration and focusing in high energy electron beams has yielded a push towards developing new devices and instruments based on plasmas. We review the most compelling of these new scenarios: plasma wakefield acceleration up to TeV/m; unprecedented strong focusing lenses; and ultra-high strength undulators. As these physical systems operated at very short length and time scales, we discuss the beam-plasma diagnostic challenges and opportunities at the sub-micron and sub-femtosecond level.

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Session Classification: Special session: Advanced techniques of acceleration