



Contribution ID: 169

Type: talk

Simulations of an hybrid and compact attosecond X-ray source based on RF and THz technologies

Wednesday, September 27, 2017 6:30 PM (20 minutes)

In this paper, we present beam dynamics simulations for a proposal of hybrid and compact attosecond X-ray source based on Inverse Compton Scattering (ICS). The layout consists of an S-band gun as electron source and a dielectric-loaded waveguide driven by a multicycle THz pulse to accelerate and longitudinally compress the bunch, which will then be used to produce attosecond X-ray pulses through ICS with an infrared laser pulse. The purpose of this hybrid scheme is to generate ultrashort electron bunches (shorter or equal to 1 fs rms), at moderate energies (15 to 20 MeV), with a charge of at least 1 pC and focused to a transverse size below 10 μm rms while keeping a compact beamline (shorter than 2 m), which has never been achieved using only conventional RF technologies. Simulations from the photocathode up to the ICS point are presented, looking at the influence of various parameters of the accelerating and transverse focusing devices.

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Session Classification: WG3_Parallel

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