



Contribution ID: 165

Type: talk

PWFA-FEL: An exploratory study towards an ultra-compact x-ray free-electron laser

Tuesday, September 17, 2019 5:00 PM (20 minutes)

Plasma wakefield accelerators (PWFA) are routinely accelerating electron beams to multi-GeV energies in cm-scale acceleration distances. This emerging technology is a promising approach towards ultra-compact X-ray free-electron lasers (XFELs). However, producing high-quality electron beams in plasma-based accelerators is still a challenging task. The R&D efforts within the community now concentrate on electron beam quality improvement. Novel avenues, such as the advanced plasma photocathode (aka “Trojan Horse”-injection), allow generating electron beams in PWFA with 0.1%-level energy spreads, nm-level normalized emittance, and multi-kA peak currents. This results in unprecedented ultrahigh 6D-brightness electron beams. This presentation reports on the UK STFC funded R&D project PWFA-FEL. This project aims to develop PWFA-driven FEL concepts and technologies by combining the expertise of an international expert team in PWFA, Beam Transport and FEL from the University of Strathclyde, UCLA, SLAC FACET-II, and the Daresbury Laboratory CLARA. Further, we show simulation and experimental progress in generating these unprecedented beams and discuss new capabilities such as sub-femtosecond coherent x-ray pulses from ultra-compact XFELs. These bright X-ray flashes may allow, the observation and the study of electron dynamics within molecules on their natural timescale in university and industry-scale laboratories.

Primary author: HABIB, Fahim A. (SUPA, Department of Physics, University of Strathclyde, Glasgow, UK and Cockcroft Institute, Sci-Tech, Daresbury, UK.)

Co-authors: HEINEMANN, Thomas (Uni Strathclyde / DESY); SCHERKL, Paul (University of Strathclyde); MANAHAN, Grace G.; BOULTON, Lewis (University Of Strathclyde / DESY); NUTTER, Alastair (University of Strathclyde); ULLMANN, Daniel (University of Strathclyde); BEATON, Andrew (University of Strathclyde); Dr WILLIAMS, Peter (STFC Daresbury Lab.); ANGAL-KALININ, Deepa (STFC, Daresbury Laboratory); CLARKE, Jim (STFC); Prof. RAUBENHEIMER, Tor O. (Stanford University); Dr HEMSING, Erik (SLAC); BRUHWILER, David; CARY, John R.; Dr HOGAN, Mark (SLAC National Accelerator Laboratory); Dr YAKIMENKO, Vitaly (SLAC); ROSENZWEIG, James (UCLA); Dr MCNEIL, Brian (University of Strathclyde & Cockcroft Institute); Prof. HIDDING, Bernhard (Scottish Universities Physics Alliance, Department of Physics, University of Strathclyde; Cockcroft Institute, Sci-Tech Daresbury)

Presenter: HABIB, Fahim A. (SUPA, Department of Physics, University of Strathclyde, Glasgow, UK and Cockcroft Institute, Sci-Tech, Daresbury, UK.)

Session Classification: WG4 - FEL

Track Classification: WG4 - Application of compact and high-gradient accelerators