



Contribution ID: 93 Contribution code: TUP17

Type: Contributed Poster

Brilliant X-Ray Free Electron Laser Driven by Resonant Multi-Pulse Ionization Injection Accelerator

Tuesday, 23 August 2022 17:40 (20 minutes)

Laser Wakefield Accelerators are now sufficiently mature to provide GeV scale/high-brightness electron beams capable of driving Free Electron Laser (FEL) sources. Here, we show start-to-end simulations carried out in the framework of the EuPRAXIA project of a Free Electron Laser driven by an LWFA accelerator in the Resonant Multi-Pulse Ionisation Injection (ReMPI) framework. Simulations with this model using a 1 PW Ti:Sa laser system and a 20 cm long capillary, show the injection and acceleration of an electron beam up to 4.5 GeV, with a slice energy spread and a normalized emittance below 4×10^{-4} and $80 \text{ nm} \times \text{rad}$, respectively. The transport of the beams from the capillary exit to the undulator is provided by a matched beam focusing with a marginal beam-quality degradation. Finally,

3D simulations of the FEL radiation generated inside an undulator show that $\approx 10^{10}$ photons with central wavelength of 0.15 nm and peak power of $\approx 0.3 \text{ GW}$ can be produced for each bunch. Our start-to-end simulations indicate that a single-stage ReMPI accelerator can drive a high-brightness electron beam having quality large enough to be efficiently transported to a FEL undulator, thus generating X-ray photons of brilliance exceeding $10^{25} \text{ ph/s/mm}^2/0.1\%bw$

I have read and accept the Privacy Policy Statement

Yes

Primary author: Dr TOMASSINI, Paolo (CNR-INO and ELI-NP)**Co-authors:** Dr GIANNESI, Luca (INFN-LNF, Elettra Sincrotrone Trieste); GIRIBONO, Anna (Istituto Nazionale di Fisica Nucleare); NGUYEN, Federico (Ente per le Nuove Tecnologie, l'Energie e l'Ambiente); Dr GIZZI, Leonida A. (CNR-INO and INFN-PI)**Presenters:** Dr TOMASSINI, Paolo (CNR-INO and ELI-NP); Dr GIANNESI, Luca (INFN-LNF, Elettra Sincrotrone Trieste); GIRIBONO, Anna (Istituto Nazionale di Fisica Nucleare); NGUYEN, Federico (Ente per le Nuove Tecnologie, l'Energie e l'Ambiente); Dr GIZZI, Leonida A. (CNR-INO and INFN-PI)**Session Classification:** Tuesday posters**Track Classification:** Novel acceleration and FEL concepts