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FEL-quality 5GeV e-bunches with the Resonant Multi Pulse Ionization injection scheme.

Wednesday, 18 September 2019 19:00 (1 hour)

The production of high-quality electron bunches in LWFA relies on the possibilities of both injecting ultra-low emittance bunches in the plasma wave and preserving their quality during the acceleration. Among the recently proposed ultra-low emittance LWFA schemes, the Resonant Multi-Pulse Ionization injection (ReMPI) [1] is flexible and relies on commercially available laser technology. In ReMPI a train of pulses excites, through a MP-LWFA [2], a large amplitude plasma wave that traps electrons extracted from field-ionization. The ionization occurs by means of a dedicated second/third harmonics pulse, focused behind the train.

Here we will show, by means of s2e simulations, that high-quality 5GeV bunches can be generated by using a 800TW-Ti:Sa laser system.

The train of pulses can be generated by using the TeMPI scheme [3], whose exact simulated time-shape has been incorporated in the LWFA simulation. Results show that FEL-quality, 30pC/3kA beams can be obtained, being the slice energy spread close to the peak current $\sigma(E_s)/E_s \simeq 7 \cdot 10^{-4}$, with a slice normalized emittance of $\epsilon_{n,s} \simeq 70 \text{ nm} \cdot \text{rad}$.

[1] P. Tomassini et al, Phys. Plasmas 24 103120 (2017).

[2] D. Umstadter et al., PRL 72, 1224 (1994).

[3] L. Labate et al., Quasi-Lossless Pulse Train generation by Early-Amplitude division (submitted).

Primary authors: TOMASSINI, Paolo (CNR-INO); Dr LABATE, Luca (Istituto Nazionale di Ottica - Consiglio Nazionale delle Ricerche); Dr TERZANI, Davide (CNR-INO); Dr GIZZI, Leonida Antonio (CNR-INO and INFN)

Presenter: TOMASSINI, Paolo (CNR-INO)

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