

ATTRACT TWD Symposium: Trends, Wishes and Dreams in Detection and Imaging Technologies



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Plasma Acceleration staging

This work will be performed in collaboration with HU (Israel) and UCLA.

Summary

The basic of Laser Wake field acceleration (LWFA) scheme is limited by the diffraction of the laser pulse, the de-phasing of the electron bunch and finally by laser energy depletion. To overcome these three limitations of LWFA schemes various solutions were proposed and demonstrated, except for laser energy depletion. Concatenating (staging) tens GeV-level acceleration units is a natural solution to drive X-FEL photon sources. This approach is taken by BELLA project at USA. However, employing conventional optics to couple the laser energy into the acceleration region sets the length of a single unit to more than one meter. We propose demonstration of employing the curved capillaries (developed in Hebrew University) to combine guided multiple high intensity laser pulses (from FLAME laser system at SPARC_LAB) into a single channel and accelerate the electrons injected by the SPARC_LAB high brightness photoinjector. The proposal is based on an initial demonstration by Hebrew University group of laser beam combining by the curved channels and the current development of external injection schemes (EXIN) at SPARC_LAB. This proof of principle experiment can lead to the compact multistage LWFA acceleration channel where the interaction with electron bunch takes place. In our scheme, the overall length of a basic accelerating unit that combines two high intensity beams unit is about 5 cm (not limited to) leading to a significant reduction in the overall length of the accelerator. The plasma channels in this experiment were created using ablative capillaries. It can be easy extended to other capillary channels where the discharge is mainly conducted by gas.

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