3P12

自己生成磁場による超高強度レーザー生成高速電子の制御に関する研究

PW laser-driven relativistic electron beams guiding by self-generated magnetic field in target with spatial gradient of resistivity

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Recent advances in PW high-intensity laser have fueled the fast ignition (FI) fusion research, which requires efficient heating of pre-compressed high-density fuel by an intense relativistic electron beam (REB) energy deposition. However, there are some problems of REB currently which reduce the fast electron to hot-spot coupling efficiency in FI regime. Some too energetic electrons generated by laser-plasma interaction become so unstoppable that they cannot deposit their energy to the fuel core. Also, the laser-accelerated electron beams have a large divergence angle (> 90°) and reduce the heating efficiency significantly. Therefore, understanding the details of REB generations and transport is critical for FI. Currently, some elegant strategies have been devised to collimate REB propagation during the generating point to the fuel core, including the external and self-generated magnetic-field with a kT range, there still exists a challenge of confining the REB transport within a small divergence angle and limiting the tendency of REB resistive and collisional energy losses over the dense materials. Self-generated magnetic field arises from a resistive return current, and its difference of the return currents between the target interface with different resistivity materials produce the magnetic field to confine the REB.

Therefore, it is necessary to investigate how to exploit self-generated magnetics field to control the REB transport with a special target, which still satisfy the effective collimation of REB and small energy losses at the same time. Our current study aims at investigating the guiding of the REB transport by using self-generated resistive magnetic field with a special target (Aluminum cylinder is imbedded in CH target) in order to enhance the coupling efficiency of laser to hot-spot region. PICLS simulations indicate that the proposed target will confine REB very well, and LFEX laser will be used in our experiment to study the REB transportation performances to the hot spot in fast ignition field.

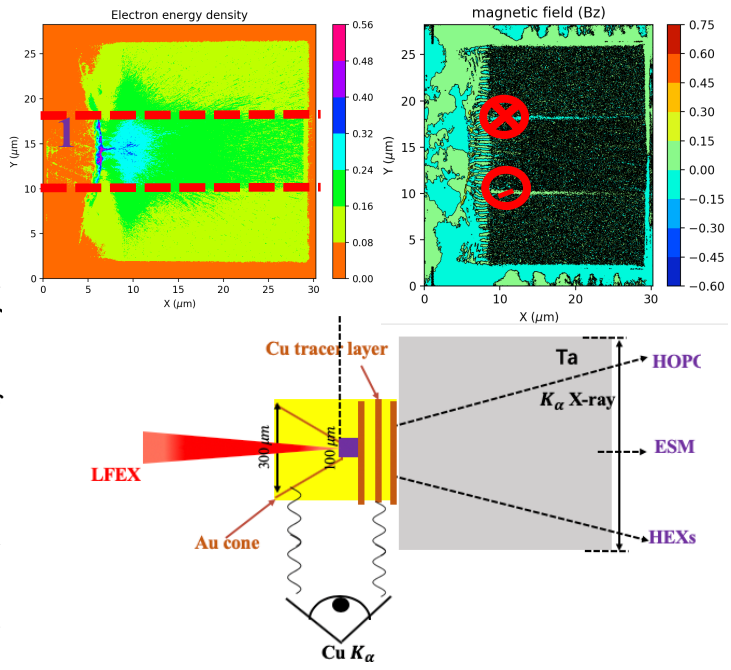

Figure. (a) REBs are guided in the Al transportation region, (b) self-generated magnetic field is in the interface of our proposed target by using PICLS simulation. (c) Experimental setup.
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