

Collimation and bunching of laser-driven ion beam

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In laser-driven ion acceleration, there are issues, including repetitive ion source, energy efficiency from laser to ion beam, ion beam quality, laser efficiency, particle energy, the total number of ions accelerated, etc. [1] We have worked on a multi-stage laser ion acceleration in order to control the ion beam quality and to fulfill the requirements toward laser-ion cancer therapy.

Figure 1 shows an example simulation for the beam bunching of the pre-accelerated ion beam. The longitudinal electric fields generated at the target surfaces are designed to reduce the velocity tilt as shown in Fig. 1. Figure 2 shows an example of a simulation model of the ion-beam collimation. The ion beam transverse divergence is suppressed by the walls behind the target. At the walls behind the target, the transverse electric field is also created to collimate the pre-accelerated ion beam. In Fig. 2 the Al thin foil substrate has another fine structure to absorb the laser energy efficiently. In this paper, we present the latest research related to the collimation and bunching of laser-driven ion acceleration.

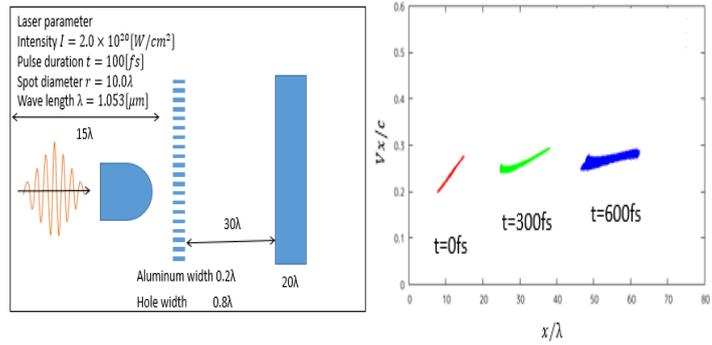


Fig. 1 The bunching of the pre-accelerated ion beam is realized by the multi-foil target.

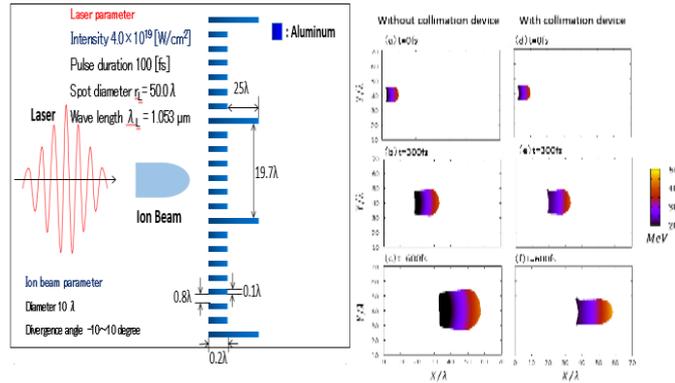


Fig. 2 The ion beam collimation is realized by the structured target shown here. The transverse electric field at the walls behind the thin foil target reduces the pre-accelerated ion beam transverse divergence.

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References

[1] S.Kawata, et al., Laser Therapy, 22, 103(2013).