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Parametric study of proton beams driven by 200TW laser system using a tape driven target system

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Ultra-short intense laser-plasma interaction comprises diverse physical processes resulting in particle acceleration and generation of radiations that are promising for future accelerator, material and medical fields. In order to generate high quality proton beam and use them as a diagnostic tool, it is important to investigate correlations between laser and the proton beam parameters. In this work, we investigate the scaling of proton beam parameters, for instance, maximum energy, flux and beam temperature to incident laser parameters (200 TW, fs laser system at Shanghai Jiao Tong University, China). For a systematic study, we used recently developed tape-driven target system, which can produce stable and reproducible proton beam. The results show fast scaling for variation of the laser energy, whereas, in case of the focal spot variation the maximum proton energy scales moderately with the laser intensity. The dependence of maximum proton energy on laser pulse duration, while keeping laser energy and focal spot size fixed, was also investigated. This information would be helpful for developing next generation accelerators and to predict properties of proton beams to be used for applications in radiography or radiotherapy.

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