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P4.2017 Impact of the laser pulse parameters on the angular-spectral distributions of protons accelerated from its tight focus

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Today one of the important issues of the laser technologies is the development of the highpower laser facilities. In despite of the rapid growth of powers, which magnitudes have already broken through the PW values, the problem of achieving the extraordinary intensities and their measurement stays topical. For the considered characteristics of the beams, such as possible peak intensity and tightness of the focal spot, traditional methods of the laser diagnostics in the focal area are out of the applicability range. New methods should take into account the fact that any target will be ionized by such ultraintensity laser field, at the same time phenomena underlying the new technique should depend only on the laser parameters, i.e. they need to be free from plasma effects. The process of the particle (protons or electrons) acceleration can act as such alternative approach. To satisfy the requirement of smallness of the plasma effects, the rarefied gases or ultrathin nanofoils should be used as sources of the charged particles. This report is devoted to the laser diagnostics via proton acceleration. The laser intensities in the range from 10^21 to 10^23 Wcm^-2 do not achieve the relativistic values for protons. It means that the amplitude of the particle oscillations is negligible as compared with characteristic scales of the laser beams. This assumption allows us using approximation of ponderomotive force, which is proportional to the gradient of the laser intensity. Performed calculations show the dependence of the angular-spectral characteristics of protons on the laser parameters, such as peak intensity, spatial distribution, focal spot size and pulse duration, so that the proton acceleration could be used for their diagnostics. However since proton drift is insignificant during the interaction time, temporal form of laser pulse does not affect particle final characteristics (for the same-energy pulses).
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