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Directed Coulomb explosion regime of proton acceleration by ultra-intense ultra-high contrast and ultra-short laser pulses. STEPAN BULANOV, VLADIMIR CHVYKOV, CUOS, U. of. Mich., ANDREI BRANTOV, VALERY BYCHENKOV, Phys. Inst., RAS, ALESSANDRO FLACCO, ALAIN GUEMNIE-TAFO, LOA, GALINA KALINCHENKO, TAKESHI MATSUOKA, PASCAL ROUSSEAU, STEPHEN REED, VICTOR YANOVSKY, CUOS, U. of. Mich., DALE LITZENBERG, Dep. Rad. Oncology, U. of. Mich., VICTOR MALKA, LOA, ANATOLY MAKSIMCHUK, CUOS, U. of. Mich. — Higher intensity and higher contrast are required for the ultra short pulses to accelerate protons up to therapeutic energies of over 200 MeV. 50 TW Hercules laser at the University of Michigan, which can be maintained up to 500 TW, can achieve 10^{21} W/cm^2 intensity with the contrast ratio of 10^{-11} between the peak intensity and the ASE. The performed under the anticipated experimental conditions PIC simulations show the maximum energy and the narrow peaked at high energies spectrum of accelerated protons that are of interest to medical applications. The results of PIC simulations are compared with the experimental ones. We found that the regime of directed Coulomb explosion, when the charge separation electric field is combined with the direct proton acceleration by the laser pulse, is the most efficient for proton acceleration by a tightly focused laser pulse.

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