LASER-DRIVEN ACCELERATION OF LOW DIVERGENCE PROTON BEAMS

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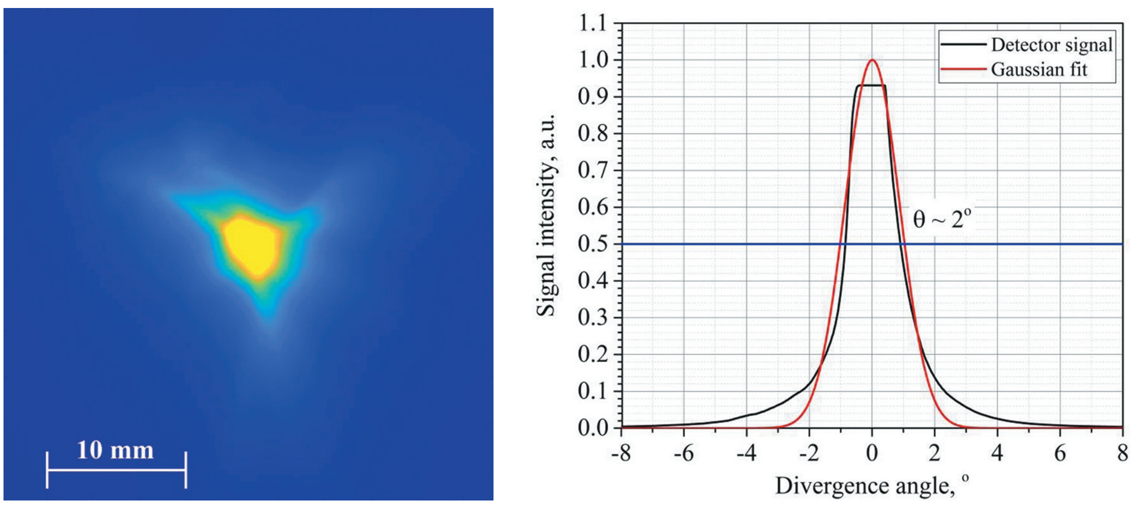
We present experimental results of proton laser acceleration from 6 um thick aluminum foils and ultrathin diamond-like carbon films with thickness of 100 nm under irradiation by femtosecond laser pulses with peak intensity up to $5 \cdot 10^{20}$ W/cm^2. To prevent the destruction of ultrathin targets by amplified spontaneous emission prepulses, an additional temporal contrast enhancement system based on double plasma mirror was employed. The use of this system led to decrease in prepulse intensity up to 10^4 times [1−4].

It's been shown that reducing the targets thickness from 6 um to 100 nm doesn't lead to a significant change in proton cutoff energies. At the same time irradiation of ultrathin targets resulted in a fivefold gain in angular yield of protons with energies above 600 keV: from $2 \cdot 10^{10}$ srad^{-1} to 10^{11} srad^{-1}, which is attributed to an increase in their number in the low-energy part of the spectra.

According to measurements using an image plate type photoluminescent detector, the angular divergence of the proton beam from 50 nm thick diamond-like films is approximately 2°.



a *b*

Fig. 1. Proton beam image taken with image plate detector, installed 12.5 cm from the target (*a*). Horizontal cut of proton beam picture (*b*)

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