PULSE-PERIODIC LASER-DRIVEN HARD X-RAY SOURCE


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Laser electron accelerators are considered as a novel high brightness x-ray source with unprecedented features such as small size and narrow divergence. These advantages make this source a promising diagnostic for variety of applications especially in radiography. For the most future applications it is necessary to enhance total charge of electron bunch.

Most laser plasma electron acceleration experiments are performed at irradiation of low density targets (gas-filled capillaries, gas cells etc.). Highly collimated quasimonochromatic electron bunches with energies up to several GeV are produced [1,2]. Typical charges of these bunches are of the order of tens of picoCoulombs. Several approaches were examined [3,4] to increase the charge, but up to data these regimes haven’t been investigated completely.

We report on experiments on electron acceleration from high density gas jets \((n_e \sim 10^{20} \text{ cm}^{-3})\) which were performed on 100 TW femtosecond laser facility (800 nm, 25 fs, 10 Hz). Gas jet parameters were measured using interferometry method.

Relativistic electron bunch spectra were obtained in experiments with various gas jet parameters and the total charge of the electron bunches were estimated.

Generated electron beams were converted into hard x-ray bremsstrahlung radiation via Ta slab placed few centimeters after gas target. Yield of hard x-rays and their spectrum temperature were measured. Hard x-ray doze on the axis for a distance of 2 m from the source is evaluated to be \(\sim 2.5 \text{ mrad/shot}\).


