Optimization of laser-plasma γ-rays source based on 100 TW femtosecond laser for radiography applications

Flegentov V A[@], Safronov K V, Gorokhov S A, Shamaeva N N, Tischenko A S, Fedorov N A, Kovaleva S F, Zamuraev D O, Shamraev A L and Potapov A V

Federal State Unitary Enterprise "Russian Federal Nuclear Center—Academician Zababakhin All-Russian Research Institute of Technical Physics", Vasilieva 13, Snezhinsk, Chelyabinsk Region 456770, Russia

[@] vflegentov@gmail.com

Laser-plasma electron accelerators are attractive sources of bremsstrahlung radiation (BR) for future radiography applications because of unique set of their intrinsic characteristics: high energy of emitting photons (tens of MeV), short pulse duration (∼ps), small radiation emitting area (hundreds of μm). Femtosecond lasers have prospects for applications in pulse radiography of moderate size objects (tens of mm), as for imaging of stationary objects by use of pulse-periodic radiation regime (∼10 Hz).

100 TW femtosecond laser based γ-rays source parameters measurement and optimization experiments has implemented for pulsed radiography purposes. BR bursts were generated by interaction of high intensity (up to $5{\cdot}10^{19}$ W/cm^2) laser pulses with planar 500 μm thickness W target. The spectrum of generated BR ($E_{\mathrm{ph}} > 0.5$ MeV) was measured. The measured size of radiation emitting area $\sim$ 300 μm. BR yield was optimized by varying ASE (amplified spontaneous emission) prepulse contrast, and by altering laser focusing conditions on target.