Spatial and pulse shape dependence of Kα source from high contrast fs laser plasmas in regime of Relativistic Engineering

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Advanced Photon Research Center, Japan Atomic Energy Agency — Interaction of intense Ti: Sapphire laser with Cu foil targets has been studied by measuring hard X-ray generation. Hard x-ray spectroscopy and Kα X-ray conversion efficiency (\(\eta_K\)) from Cu plasma have been studied as a function of laser intensity via pulse duration scan (60 fs \(\sim 600\) fs), laser pulse energy scan (60 mJ \(\sim 600\) mJ) and target displacement scan from best focus. For intensity \(I > 1 \times 10^{17}\) W/cm\(^2\), the Cu \(\eta_K\) keep on increasing to reach a maximum value of \(1 \times 10^4\) at an intensity \(I = 1 \times 10^{18}\) W/cm\(^2\). The focusing was varied widely to give a range of intensities from \(10^{15}\) W/cm\(^2\) \(\sim 10^{18}\) W/cm\(^2\). Two individual emission peaks are obtained, one is at best focal spot and the other is at larger target offset corresponding to \(\sim 10^{15}\) W/cm\(^2\). Each peak is corresponding to different energy absorption mechanism. In addition, when we introduce slightly detuning of compressor gratings at the best focal condition, it shows \(\eta_K\) generated by negatively skewed 100 fs pulse width laser irradiation reach \(5x10^{-4}\) and almost 7 times greater than the case of positively skewed pulse. Vacuum Heating is greatly stimulated in this case and precisely control of pre-plasma is the key factor in tuning control of X-ray emission in relativistic fs regime.

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