Bright and stable table-top x-ray source from a Laser-Plasma Accelerator

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Brilliant x-ray sources with photon energies of a few keV to 10's of keV have various applications ranging from medical, chemical and material science to the diagnostic of the laser-plasma interactions. Over the last two decades, betatron radiation from laser-plasma interaction, has been investigated [1]. When an ultra-intense fs-laser pulse is focused on a gas target, the electrons are expelled from the focal region forming an accelerating structure in the wake of the laser pulse [2]. The transverse electric field and the azimuthal magnetic field inside the plasma lead to transverse oscillation of the electrons producing betatron radiation [3]. The photon flux and energy of such radiation is dependent on energy of the electron-bunch (E), number of electrons in the bunch(N_e), plasma density (n_e) and the amplitude of the transverse oscillation of the electrons (r_β) [4].

At the JETi200 laser system in Jena, Germany, we intend to implement new experimental technique to enhance the betatron yield and the energy by controlling the mean off-axis injection angle employing tilted shock fronts. 2D particle-in-cell simulations have been performed showing a strong increase in the betratron oscilla- tion and x-ray yield for tilted shock injection mech- anism. We expect to inject the electrons inside the wake bubble far from the laser axis [5] and a matching increase in transverse oscillation of the electrons leading to enhanced betatron yield and energy [Fig: 1].

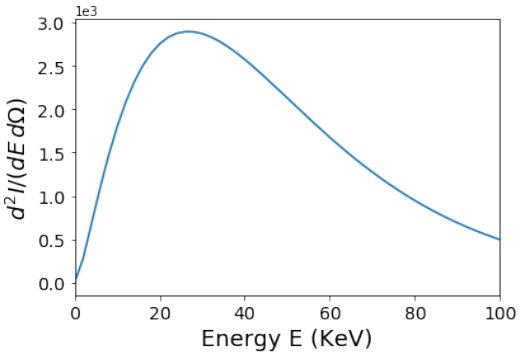

Figure 1: *The expected betatron spectrum with E = 500 MeV and* $n_e = 10^{19}$

References

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