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Feasibility of LWFA's for X-ray induced acoustic computed tomography

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X-ray induced Acoustic Computed Tomography (XACT) is an imaging modality that combines the high absorption contrast and penetration depth of x-rays with the 3D propagation advantages provided by high-resolution ultrasound waves. Absorbed x-rays in a sample cause a localized heating (<mK) and thermoelastic expansion inducing a detectable ultrasonic emission. Effective generation of sound waves require that the energy deposition happens in a period shorter than the stress confinement time of the material ($\tau_s \approx$ ns for most applications). Until now, XACT experiments have been performed with industrial x-ray tubes (up to 270kvp) with low energy tunability, broad energy spectra and high beam divergences (40°). Laser Wakefield Accelerators (LWFA) on the other hand, can generate radiation with narrower energy widths, smaller divergences, and better energy tunability. Here, we study the energy deposition (and thus the acoustic response) of betatron, bremsstrahlung and inverse Compton scattering radiation spectra generated by a LWFA and compare them with a commercial x-ray generator for different systems of interest in biomedical applications and discuss the feasibility of these sources to perform future XACT experiments

Acknowledgments

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