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Very High Energy Electrons with high charge and moderate energy spread from laser- wakefield acceleration

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The capability to sustain high accelerating gradients ($\sim$ 100s GV/m) in plasmas leads to electron bunches at GeV-scale energies in short distances, making Laser-Plasma Acceleration (LPA) a promising approach to high gradient particle accelerators. Among injection schemes, ionization injection is one of the most practical with outstanding numerical results (see ReMPI acceleration).

An intriguing application of LPA is in the context of *Very High Energy Electrons* radiotherapy (VHEE-RT). In a recent work we explored the use of laser-driven electrons, with typical dose per shot ~ 0.1 Gy and high peak dose rate $\sim 10^{12} - 10^{13}$ Gy/s, as an effective approach to VHEE-RT, with energy range $\sim 100 - 250$ MeV to limit lateral dose spread.

Spectral features and quality of typical RT bunches affect dose deposition: these can be improved usually at the cost of bunch charge. Here we propose a laser-driven plasma "bubble" acceleration scheme of 115 pC, ionization-injected bunch at $\mathcal{E} = 220$ MeV with $\sigma_{\mathcal{E}} = 5.6\%$, providing more refined electrons for VHEE-RT. A tailored downramp is shown to be needed to prevent emittance growth. Moreover we show that full-PIC results are well reproduced by a model based on beam envelope equation, solved with a standard Runge-Kutta method.

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