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Beam dynamics studies and optimization for a compact Cband LINAC for FLASH radiotherapy

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Developing medical accelerators for clinical use presents significant challenges, particularly for FLASH radiotherapy, where specific beam parameters are essential to activate the FLASH effect. At Sapienza University, a new electron FLASH LINAC is being developed, designed to deliver FLASH electrons and adaptable for very high-energy electron (VHEE) applications. This work focuses on overcoming the inherent challenges of FLASH radiotherapy: achieving high energy gain in RF structures while transporting high-current electron beams within a compact, cost-effective accelerator. These goals are often at odds, as the high peak currents required for the FLASH effect introduce beam loading, reducing energy gain. Through extensive simulations and optimizations, the accelerator design has been refined, with key improvements in the power supply, RF cavities, and source configuration. This study marks a crucial step toward the realization of compact, scalable, and efficient accelerators for advanced radiotherapy, offering innovative solutions for future medical treatments.

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