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Experimental Validation of a Double-Gridded Lens System for High-Frequency RFQ Injection

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As part of CERN's Medical and Societal Applications program, a system composed of an extractor and two-gridded lens has been experimentally validated as a compact Low-Energy Beam Transport (LEBT) solution, critical for integrating pre-injectors into compact medical accelerators. The system is under 90 cm long and it is designed to extract transport and transversely match ion beams at an energy of 15 keV/u into a 750 MHz Radio Frequency Quadrupole (RFQ) (q/m = ½ to 1). A novel ion extractor electrode has been integrated into a NEC ion source, yielding proton currents of the order of 0.1 mA, for injection into the high-frequency RFQ. The lens system delivers the stringent transverse focusing required by the RFQ. This work presents the design and implementation of the novel lens system, evaluates its experimental performance, and compares it to beam optics simulations. In parallel, its performance is assessed against a more compact, direct extraction scheme designed for immediate RFQ matching.

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