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Design and construction status of the diagnostic system for the Compact LAser Plasma Accelerator II

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Over the past two decades, laser-driven proton radiotherapy devices have garnered significant attention among novel accelerator technologies, due to their high acceleration gradient. Peking University is engaged in the construction and development of CLAPA-II (the Compact LAser Plasma Accelerator II), a proton therapy facility which utilizes a laser-plasma acceleration scheme. This facility comprises two horizontal and vertical beam transmission lines, operating at a repetition rate of 1Hz, capable of delivering 10^8-10^10 protons per second. We have implemented both interceptor and non-interceptor detectors for precise measurements of proton beam. Notably, this is the first instance where an ionization chamber and cavity BPM have been integrated into a laser proton therapy accelerator. To validate the performance of our beam diagnostic system, we have established an offline test platform that simulates the laser proton beam. The results indicate that the offline test resolution of the cavity BPM has achieved 0.2μm in the range of ±3mm. Furthermore, we explored the absolute collection efficiency and particle recombination factor of ionization chamber with ultra-high dose rate proton beams, leveraging the laser-driven ultrashort electron beam generated by Peking University's CLAPA-I facility. This paper provides an overview of the beam diagnosis system's overall layout, accompanied by a detailed description of the detector design and corresponding measurement results.

Footnotes

Funding Agency

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Yes

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