The Achromat beamline design of the PLAPA

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Based on the research experience of CLAPA [1,2] (Compact Laser Plasma Accelerator), a new laser accelerator used for proton therapy facility named PLAPA (Petawatt LAser Proton Accelerator) is proposed and under design by PKU. This facility will for the first time adopt the near critical density target, consisted of the self-sustained foil material and the carbon nanotube, as the key technology in laser-driven ion accelerators. The laser accelerator is able to repeatedly generate proton beams with high peak flux and short temporal duration in the energy level of multi hundreds MeV. The resulting beam can meet most of the therapeutic needs.

It is always an important step that how to design a beam transport line suitable for the beam accelerated by PLAPA. Through the design and construction of the transmission line for the laser-accelerated ion beam, the beam with 100 MeV and 0~±5% energy spread can be accurately transmitted. Science design process, the achromat lattice is designed for control the envelope growth caused by dispersion and large energy spread. Superconducting solenoids and magnets with mixed magnetic field are used to make the beam line more compact.

[1] Zhu J G, Zhu K, Tao L, *et al.*, Beam Line Design of Compact Laser Plasma Accelerator[J]. Chinese Physics Letters, 2017(05):51-54.

[2] Zhu J G, Wu M J, Liao Q, *et al.*, Experimental demonstration of a laser proton accelerator with accurate beam control through image-relaying transport[J]. Physical Review Accelerators and Beams, 2019, 22(6): 061302.