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Ion Transport Beamlines for Laser Plasma Accelerators

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Theoretical and multidimensional computer simulations have shown that several hundred MeV or even GeV ions can be expected from the interaction between petawatt-level laser pulses with different targets. High ion energies, together with beamlines to achieve low energy spread with high controllability and stability can form the core of a new generation of ion accelerators. Such a high performance laser-driven ion beam system has numerous potential applications such as injectors for conventional accelerators, radiation therapy, as well as high energy density laboratory physics and material science studies. Ion beamlines using pulsed solenoids, magnetic quadrupoles, and RF cavities to collect, transport and shape the ion beams produced by the laser-driven ion sources will be reviewed. Alternating-gradient canted cosine theta (AGCCT) superconducting magnets are being developed at LBNL for future compact proton gantries. A compact beam transport and energy selection system using active plasma lens and AGCCT magnets to transport and select ions produced from laser-driven ion sources will also be presented.

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