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Multiple beam acceleration based on proton-driven wakefield in a hollow plasma channel

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Proton-driven plasma wakefield acceleration has recently been proposed to accelerate a bunch of electrons to more than 600 GeV in a single stage of acceleration. This may pave the way to realising the energy frontier colliders based on this scheme in the future. However, the resulting beam quality and luminosity are not good enough for the direct applications. In this paper, we propose a new scheme of multiple beam acceleration from the proton-driven wakefield in a hollow plasma channel. The simulation results show that multiple electron or positron bunches can be accelerated simultaneously in the proton-driven wakefield at hollow plasma channel. The resultant beam quality is well preserved after long distance propagation in plasma. In addition, this multiple beam acceleration scheme enhances the collider luminosity significantly.

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