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Complete elimination of BBU in open structured channels

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The plasma-based particle acceleration promises very high accelerating fields. At the same time, it is widely accepted that uniform plasma only can support acceleration of negatively charged witness particles. Hollow plasma channels would be suitable for acceleration of witnesses of both charges due to the absence of focusing fields inside the vacuum channel core. Unfortunately, beams in the hollow channels suffer from beam break-up (BBU) due to fast growth of skewed (asymmetric) wakes. The BBU leads to a fast beam loss and prohibits a useful application of the round hollow channels in bulk plasmas.
Here, I show that properly structured hollow plasma channels allow to eliminate BBU instability completely. For the first time, high-gradient particle acceleration becomes feasible in hollow channels over long distances. Moreover, even long-beam drivers with a shaped current profile remain stable in such structured channels. This opens the unique possibility to achieve extremely high transformer ratios (TR˜10 or even higher) in beam-driven accelerators.
The concept can be applied both to low density plasma channels as well as to corrugated solid-state structures. Full 3D electromagnetic PIC simulations will be presented.

Available for oral presentation in a session

Yes

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Session Classification: Poster Session