Contribution ID: **364** Contribution code: **WEP048** Type: **Poster Presentation**

Investigation of transverse instability in efficient plasma-based accelerators

Wednesday 13 August 2025 16:00 (2 hours)

Plasma-based accelerators offer a promising route to compact high-energy particle sources. However, recent theoretical work* has suggested that accelerating a low-energy-spread electron beam may not be feasible at high efficiency because of the excitation of transverse beam break up (BBU) instability. This instability, which leads to a growing spatio-temporal oscillations of the beam centroid, is a consequence of a significant misalignment or loss of symmetry between the beam and the accelerating structure (ion cavity) and arises because of the coupling between the accelerating beam electrons and the plasma sheath electrons surrounding the ion cavity. The instability deteriorates the electron beam parameters (notably, the beam emittance) and hinders the usefulness of the plasma-based accelerators for some potential applications like, particle colliders. Here, using particle-in-cell simulations and analytical modelling, we evaluate the centroid evolution of a partially misaligned trailing electron bunch coupled with a plasma accelerator and provide novel solutions for its suppression. We also present preparation status of an experiment designed to characterize the transverse instability on a well-defined externally injected electron beam from a conventional linac in a CO2 pulse driven LWFA at Accelerator Test Facility (ATF) at Brookhaven National Laboratory (BNL).

Please consider my poster for contributed oral presentation

No

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

- V. Lebdev, A. Burov, S. Nagaitsev, PRAB 20, 121301 (2017).

Funding Agency

We acknowledge the support by the U.S. Department of Energy, Office of Science under Award No. DE-SC0024277, NSF CAREER Award PHY-2238840, resources of NERSC facility, operated under contract No. DE-A

I have read and accept the Privacy Policy Statement

Yes

Author: PATHAK, Naveen (Stony Brook University)

Co-authors: JAIN, Arohi (Stony Brook University); PALMER, Mark (Brookhaven National Laboratory); FEDURIN, Mikhail (Brookhaven National Laboratory); VAFAEI-NAJAFABADI, Navid (Stony Brook University); LI, William (Brookhaven National Laboratory)

Presenter: PATHAK, Naveen (Stony Brook University)

Session Classification: WEP: Wednesday Poster Session

Track Classification: MC3 - Novel Particle Sources, Acceleration Techniques, and their Applications