EUROPEAN NETWORK FOR NOVEL ACCELERATORS

EuroNNAc4

NPACT supported by EU via I-FAST

Contribution ID: **47** Type: **Invited talk**

Stable and high quality electron beams from staged laser and plasma wakefield accelerators

Thursday, 22 September 2022 10:15 (20 minutes)

Using Laser-wakefield accelerated (LWFA) electron beams to drive a plasma-wakefield accelerator (PWFA) has been at the center of a multi-partner collaboration during the last few years. The motivation for doing so is two-fold: Firstly, current LWFA beams achieve peak currents beyond the capabilities of most dedicated PWFA facilites (with the exception of FACET-II), therefore our approach can act as a scalable, easily accessible toy model for high-current PWFA research. Secondly, while LWFA can yield >nC total charge beams with energy conversion factors >10 percent, but due to dephasing and the heating of the plasma electrons by the laser field their emittance is too large e.g. for driving an FEL. If the LWFA beam energy can by coverted efficiently in a cold PWFA stage to a high-quality beam, this will bring us a step closer to the dream of a compact ultralow-emittance beams source. We will show latest experimental results on the stability limits and potential emittance improvement for such a staged wakefield accelerator scenario, as well as laying out the next steps for the collaboration.

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Session Classification: Special Topic