7th European Advanced Accelerator Conference

EAAC2025

Contribution ID: **609** Type: **Oral contribution**

Proposal to control BBU instability in SWFA by using adjustable rectangular dielectric waveguides

Monday 22 September 2025 17:00 (20 minutes)

Structure wakefield acceleration (SWFA) is a promising novel acceleration method being explored to develop more compact and cost-effective future accelerators. In SWFA, a high-charge drive bunch travels through a structure, exciting strong wakefields that can be used to accelerate a trailing lower-charge main bunch. A major challenge in this scheme is beam break-up (BBU) instability, which can lead to beam losses, limiting the acceleration length and ultimately the beam energy gain. While several strategies have been proposed to address this issue, we present an alternative approach consisting of an array of rectangular dielectric waveguides with independently adjustable transverse positions. This arrangement enables section-by-section correction of transverse beam momentum and offset, offering a practical solution to mitigate BBU instability in SWFA schemes and improve their viability for future accelerator technologies. To test this concept, future experiments are being planned at the CLARA facility in Daresbury Laboratory.

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Session Classification: PS2: High gradient vacuum structures

Track Classification: PS2: High gradient vacuum structures