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Measuring the beam-breakup instability in beam-driven plasma wakefield accelerators

Beam-driven plasma wakefield acceleration can sustain accelerating fields on the GV/m scale, making it well-suited for linear collider applications. However, in recent years, an efficiency-instability relation has been proposed, which limits the energy transfer efficiency from the wake to the trailing bunch that can be achieved without inducing transverse instabilities detrimental to the transverse phase space of the accelerated bunch. We discuss the efficiency-instability relation for a transversely misaligned trailing bunch and a novel method that can be used to identify the beam-breakup instability (BBU) on a dispersive dipole spectrometer and quantify the size of the instability. We show preliminary results using data from the E300 experiment at the FACET-II facility, showcasing the use of this method.

Working group

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