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Latest Results from the FLASHForward Experiment

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The FLASHForward experiment at DESY uses the FEL-quality electron bunches from the FLASH linac to perform research into the plasma wakefield acceleration of high-brightness electron bunches. This talk will provide an overview of recent results in four areas: beam quality preservation, energy efficient acceleration, high-brightness internal injection and plasma evolution studies. By precisely controlling the transverse properties of the witness bunch while simultaneously loading the wakefield longitudinally, we were able to demonstrate the preservation of the witness-bunch emittance during plasma acceleration for the first time. The emittance was preserved at the level of 2.8 mm.mrad while also maintaining > 20% instantaneous energy transfer efficiency. To improve the overall energy transfer efficiency, the driver bunch must be depleted. We will present the latest results on driver energy depletion, a novel longitudinally resolved efficiency-monitor technique and the development of plasma cells for higher witness-bunch energy gain. Brief updates will also be given on the status of density-downramp injection experiments delivering highly reproducible mm-mrad emittance electron bunches with per-cent-level energy spreads, and the combination of experimental and simulation techniques to probe the plasma evolution in our plasma cells.

Working group

WG3 : Beam-driven plasma acceleration

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