

## Experimental measurement of the saturation length of the Self-Modulation

A long, narrow bunch propagating in plasma is subject to the self-modulation (SM) instability, a transverse process. In the AWAKE experiment, we study the evolution of SM along the plasma by changing the length of plasma over which the bunch propagates. In particular, we observe the effect of the transverse wakefields on the bunch by measuring the size of the halo of defocused particles at a screen downstream from the plasma. We observe that the maximum radius of the halo changes with beam and plasma parameters. Numerical simulation results suggest that there is a correlation between the plasma length for which the halo is fully formed, and the plasma length for which the SM process saturates. We study this halo formation for different parameters, and compare it with numerical simulations results.

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