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Observing Self-Modulation Growth through Light Emission of Dissipating Wakefields

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At AWAKE, self-modulation of a long relativistic proton bunch is used to drive high-amplitude wakefields. As the proton bunch self-modulates while propagating through the 10 m long plasma, the amplitude of the wakefields grows. Measuring the wakefield amplitude directly has not been possible so far. However, as the energy stored in the wakefields is dissipated, some fraction of it is emitted as light. By measuring the intensity of the light, we observe for the first time the growth of the self-modulation process along the plasma. By varying bunch and plasma parameters, we investigate the dependencies of the self-modulation growth. When imposing a density gradient along the plasma, we also observe growth suppression, as predicted by theory.

Working group

WG3 : Beam-driven plasma acceleration

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