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Heterodyne measurement of CTR from self-modulation instability (SMI) in AWAKE

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We present the measurement setup and first results of a waveguide-integrated heterodyne measurement of coherent transition radiation (CTR) in the AWAKE experiment. As a result of the self-modulation instability, a pulse of strong CTR is expected from the modulated proton bunch passing through a CTR-screen. This radiation pulse, which has the length of the modulated part of the bunch and a frequency at the plasma frequency, is transported by overmoded waveguides over 15m to a heterodyne detector setup. With the two waveguide-integrated receivers, covering the frequency-bandwidths 90-140 GHz and 255-270 GHz, a significant fraction of the available plasma frequencies can be measured. The two mixers convert the CTR into a signal in the range of 5-20GHz that is measured on a fast oscilloscope, with a high spectral resolution of 1-3 GHz dominated by the pulse length. The first results measured with this setup on AWAKE, with the goal of precisely measuring the plasma frequency, will be presented.

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