



Contribution ID: 174

Type: talk

First results of CTR measurement of modulated proton bunch in AWAKE

Wednesday, September 27, 2017 4:18 PM (18 minutes)

We present a first measurements of microwave coherent transition radiation (CTR) emitted by a SPS proton bunch in AWAKE experiment at CERN. Detailed simulation predicts a significant and experimentally detectable amount of CTR power. Strong signal has been detected in all non-frequency-resolved detectors when proton bunch interacted with a Rubidium plasma. We used three Schottky diodes integrated into different wave-guides designed to measure a signal in 90-140, 140-220, 220-320 GHz bands. Preliminary results show a presence of harmonics of plasma frequency in CTR signals as is predicted by our CTR simulations. Also we used a quasi-optical Schottky diode, placed behind a set of 7 cut-off wave-guides mounted onto a remotely controlled wheel. This setup was used to find (roughly) a CTR carrier frequency in between of two cut-offs. We attempted a novel heterodyne detection of a CTR microwave burst based on specially designed photo-sensitive Schottky diode that mixes a microwave CTR signal with the intensity beat of two tunable CW lasers as a local frequency input, aiming at measuring the bunch modulation frequency that is expected to be equal to the plasma electron frequency.

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Session Classification: WG1_Parallel

Track Classification: WG1 - Electron Beams from Plasmas