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Suitability of GHz frequency beam position monitors for electron bunch position discrimination in the AWAKE facility

Wednesday 10 September 2025 16:00 (2 hours)

The AWAKE facility at CERN utilises proton beam-driven plasma wakefields to accelerate electron bunches in a 10-meter long rubidium plasma cell. Precise monitoring of the electron bunches in the presence of the more intense proton bunches, which have distinct temporal and spatial characteristics, requires a beam position monitor (BPM) operating in the tens of GHz frequency range, assuming Gaussian longitudinal particle distributions. Two types of BPMs, one based on Cherenkov diffraction radiation (ChDR), and the other utilising high frequency (HF) conical shaped pickups, have been explored as a method to distinguish the electromagnetic signals of the shorter electron bunches (a few ps) from those of the longer proton bunches (a couple of hundred ps) co-propagating in the AWAKE beamline. Recent tests of both BPMs in the AWAKE common beamline have been conducted across frequencies in the range 20 –110 GHz. The sensitivity of the HF and ChDR BPMs to the electron beam position was determined under various beam conditions, with and without proton bunches present. The read-out, utilising a RF front-end developed by TRIUMF, is additionally discussed.

Footnotes

Funding Agency

I have read and accept the Conference Policies

Yes

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