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Longitudinal microwave instability with long bunches in the CERN Proton Synchrotron

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Longitudinal microwave instabilities are driven by beam coupling impedance sources which have a very short wavelength compared to the bunch length. These instabilities can be a significant limitation to performance on an accelerator. In the CERN Proton Synchrotron (PS), microwave instability is mostly observed at transition crossing for ion and proton beams, when bunches are shortest. Vacuum equipment such as pumping manifolds and sector valves are suspected as a driving impedance. The method used to study the instability relies on measuring the longitudinal profile modulation of long bunches with a minimal momentum spread while debunching in the PS, with RF off and only induced voltage acting upon the beam. The low momentum spread minimises the variation in particle drift speeds and increases the duration in which the modulations are visible. The spectral analysis of the modulated beam, combined with modelling of long bunch instability growth aims to fully characterise this instability and its origin. The objective being to mitigate the instability and improve the performance and versatility of the PS beam production schemes.

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Footnotes

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Yes

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