Contribution ID: **189** Type: **Talk**

【387】Investigating LHC Electron Cloud Instabilities through Linearized Vlasov Method

Thursday 7 September 2023 15:30 (15 minutes)

The Vlasov approach models e-cloud driven instabilities on time scales beyond conventional Particle-In-Cell simulations. It uses a linear description of electron cloud forces that accounts for both the betatron tune modulation along the bunch and the dipolar kicks. Chromaticity effects can also be included. Benchmarked against macroparticle simulations using the same e-cloud force formalism, both methods agreed for strong electron clouds and experience a stabilizing effect from positive chromaticity. This stabilizing effect is consistent with observations from the LHC. For positive chromaticity the Vlasov approach predicts weak instabilities not observed in the macroparticle simulations, suggesting the existence of damping mechanisms not captured by the Vlasov approach.

Theoretical Work

Theory

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Session Classification: Accelerator Science and Technology

Track Classification: Accelerator Science and Technology