A 2-MODE MODEL TO STUDY THE EFFECT OF SPACE CHARGE ON TMCI IN THE ‘LONG-BUNCH’ REGIME

E. Métral (CERN, Geneva, Switzerland)

Abstract

- “Short-bunch” regime for TMCI (Transverse Mode-Coupling Instability): mode-coupling takes place between modes 0 and –1 (such as in CERN LHC) => Both Reactive Damper (ReaD) and Space Charge (SC) are expected to be beneficial
- “Long-bunch” regime: mode-coupling takes place between higher-order modes (such as in CERN SPS)
  - No effect expected from ReaD
  - No beneficial effect predicted from SC => Intensity threshold can only be similar to or lower than the no-SC case
- These results go in the opposite direction as theories of the past 2 decades but they go in the same direction as recent macroparticle tracking simulations with SC, which revealed a huge destabilising effect of SC in the strong-SC regime (a destabilising effect of SC was also recently revealed in a more involved theory of “convective instabilities” from A. Burov)

- SC only
- “Short-bunch” regime

- “Long-bunch” regime

\[ N_B^{th} \propto |\eta| \varepsilon I Q_y R_{SC} \]