LONGITUDINAL MODE-COUPLING INSTABILITY: GALACLIC VLASOV SOLVER VS. MACROPARTICLE TRACKING SIMULATIONS

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Abstract

- Following the same approach as for the recently developed GALACTIC Vlasov solver in the transverse plane and taking into account the Potential-Well Distortion (PWD), a new Vlasov solver, called GALACLIC, was developed for the longitudinal plane.
- In parallel, a new mode analysis was implemented for the post-processing of the results obtained through macroparticle tracking simulations.
- The results of the benchmarks performed between the two methods are presented. A good agreement has been reached between GALACLIC and the SBSC longitudinal macroparticle tracking code (as well as BLonD and MuSIC) for the two cases of Constant Inductive and Broad-Band Resonator impedances above transition. For the BBR impedance model, the longitudinal "microwave instability" observed in simulations has been undoubtedly explained by a Longitudinal Mode-Coupling Instability, whose intensity threshold is very close to the Keil-Schnell-Boussard criterion.

TRACKING SIMULATIONS

GALACLIC VS. SBSC

[Graphs and data showing comparisons between GALACLIC and SBSC for different impedances, with parameters such as $f_r$, $r_b$, and frequency $\omega_{sb}$ included.]

[Graphs showing Re(Q)/Q and Nb (10^{11} p/b) for different cases, including Constant Inductive and BBR impedances, with specific parameters like $C = 6911 m$, $\gamma_{s0} = 22.77$, $f_r = 43350.8 \text{ Hz}$, $B_0 = f_x r_b = 1.17 \times 10^{-4}$, $\rho_{eff} = 889 \text{ rad/s}$, and $h = 462$.]