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## Comparison between self-consistent and non self-consistent space charge analysis for the evolution of the coherent direct space charge modes

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The question of the mitigation of the Transverse Mode Coupling Instability (TMCI) by space charge has been discussed for more than two decades. Since few years, it has become clear that the ABS model, which has been often used in the past and which assumes an air-bag bunch in a square well, is not sufficient to properly describe the complexity of the interaction between impedance and space charge. Considering a more realistic longitudinal Gaussian distribution, a fully self-consistent treatment of space charge was performed few years ago using the circulant matrix model, which revealed the usual TMCI mechanism but with oscillation modes shifted both by impedance and space charge. In this paper, a non self-consistent treatment of space charge is analyzed, still using a Gaussian distribution, to look at the evolution of the coherent direct space charge modes. It is shown in particular that it leads to exactly the same result as the self-consistent treatment for space charge parameters below 1 and that it is a much better approximation than the ABS model for space charge parameters above 1, as it reveals clearly how the positive modes lead to negative tune shifts.

### Footnotes

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### Paper preparation format

### Region represented

Europe

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