**Developments in Synergia space-charge-induced resonance trapping**

**Abstract:**

Synergia is a beam dynamics code that can perform detailed space charge simulations of realistic accelerator designs that are applicable to advanced accelerators. We describe the space charge model and discuss thesuccessful simulation of space-charge-induced resonance trapping involving the detailed interplay between tune depression and resonances.

**Summary:**

Synergia is a fully self-consistent PIC-based beam dynamics code for performing detailed simulations of realistic accelerator designs with collective effects, especially space charge. Recent progress in Synergia includes both validation of the space charge and performance enhancements. We will describe our successful efforts to reproduce the space-charge benchmark developed by Giuliano Franchetti[1]. The benchmark tests the detailed interplay of the space charge tune depression of particles that enter into the dense core of a bunch with the nonlinear dynamics of the lattice causing resonance trapping. Our results also include a calculation of emittance growth in the longest ever full PIC simulation -- 100,000 turns including over 7 million steps.

[1] http://web-docs.gsi.de/~giuliano/research\_activity/trapping\_benchmarking/main.html