Investigating ICRF Core Physics with a Hybrid Method using δf Particles*

T.M. Austin and D.N.Smithe
[1]*Tech-X Corporation, Boulder, CO USA*

Particle-in-cell simulations of ICRF core physics yield a significant amount of noise that can overwhelm the low amplitude signals associated with ion cyclotron resonance heating. To overcome this noise we employ a hybrid approach [1] that uses a fluid model [2] for electrons and the δf particle-in-cell method [3] for ions. Noise is reduced to a level well below the amplitude of the signal and time steps are permitted to go beyond the electron time scales. With this formulation, we have explored minority heating scenarios in Alcator C-Mod and high harmonic heating scenarios in NSTX. We can also employ the fluid model for both electrons and ions to investigate cold plasma scenarios. Here we examine ion and electron test particles in both the hybrid approach and the cold fluid approach with particular attention paid to banana orbits and particle paths near resonance tips. We focus on particle orbits in poloidal planes for a single toroidal mode and present a path to the investigation of full particle orbits for toroidal mode expansions. We also illustrate some preliminary work on the investigation of non-Maxwellian distributions in the delta-f particle-in-cell simulations for the case of 1D slab geometry.

[1] T.M. Austin and D.N. Smithe, in progress.
[2] D.N.Smithe, Phys. Plasmas, **14**, 056104 (2007).
[2] N. Xiang et al., Phys. Plasmas, **13**, 062111 (2006).

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