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Non-linear modeling of RF in fusion grade plasmas[1] TRAVIS AUSTIN, DAVID SMITHE, AMMAR HAKIM, THOMAS JENKINS, Tech-X Corporation — We are seeking to model nonlinear effects, particularly parametric decay instability in the vicinity of the edge plasma and RF launchers, which is thought to be a potential parasitic loss mechanism. We will use time-domain approaches which treat the full spectrum of modes. Two approaches are being tested for feasibility, a non-linear delta-f particle approach, and a higher order many-fluid closure approach. Our particle approach builds on extensive previous work demonstrating the ability to model IBW waves (one of the PDI daughter waves) with a linear delta-f particle model [1]. Here we report on the performance of such simulations when the linear constraint is relaxed, and in particular on the ability of the low-noise loading scheme, specially developed for RF and ion-time scale physics, to operate and maintain low noise in the non-linear regime. Similarly, a novel high-order closure of the fluid equations is necessary to model the IBW and higher harmonics. We will report on the benchmarking of the fluid closure, and its ability to model the anticipated pump and daughter waves in a PDI scenario.

[1] T.M. Austin, D.N. Smithe, "Modeling ion cyclotron resonance heating using a hybrid δf particle-in-cell approach," in progress.

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