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Serendipity shape functions in NIMROD's delta-f PIC approach to energetic particle physics[1] TREVOR TAYLOR, ERIC HELD, Utah State University, SCOTT KRUGER, TechX Corporation — Wave-particle resonances can have significant effects on plasma stability even with small, resonant sub-populations. For energetic particles (EPs) in tokamak plasmas, long-wavelength modes can interact with the second-adiabatic moment of EPs produced by neutral beams, external RF sources, or fusion-produced alphas leading to greater uncertainty in plasma stability boundaries. EP closures based on the PIC algorithm have long been used in extended MHD codes to capture this important physics. Extended MHD code NIMROD has both continuum and delta-f PIC [1] drift kinetic (DK) capability. Initially, bilinear shape functions were employed to incorporate the EP, anisotropic stress tensor into NIMROD's flow evolution equation. Serendipity shape functions, up to forth-order, have been implemented in delta-f PIC DK approach in an attempt to reduce the inherent noise in deposition of particle information onto NIMROD's higher-order finite element grid. Comparisons of growth rates and eigenfunctions for linear calculations using the old bilinear and new, higher-order delta-f PIC shape functions for giant sawtooth stability in DIII-D shot 96043 [2] are presented. [1] C.C. Kim, et.al., Comp. Phys. Comms. 164, 448(2004). [2] Choi, Turnbull, Chan, Chu, Lao, et.al., Phys. Plasmas 14, 112517(2007).

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