

Status and Plans of PSI-Center Collaborations

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for the

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Outline

- HBT-EP (C.J. Hansen and Columbia Group)
 - Wall stabilization
 - Feedback algorithms
 - Equilibrium fitting
- HIT-SI/HIT-SI3 (K.D. Morgan, C.J. Hansen, T.E. Benedett, D.A. Sutherland, & T.R. Jarboe)
 - Quantitative comparison of NIMROD and PSI-TET to experimental data
 - PSI-Tri equilibrium fitting (and stability)
 - Neutral dynamics
 - BD validation metrics

Further Collaboration Work — II

- LTX (C.J. Hansen and R.P. Majeski)
 - Low wall loading (lithium pumping)
 - Equilibrium fitting
 - Non-axisymmetric resistive walls
 - Low collisionality regimes
 - Non-local 3D effects (asymmetric shell, gas puff, *etc.*)
- Pegasus (C.R. Sovinec and Jake)
 - Non-solenoidal ST startup w/biased plasma sources (LHI)
- MPDX and TREX (C.R. Sovinec and J. Egedal)
 - Reconnection and internal solenoid studies
 - HiFi

Further Collaboration Work — III

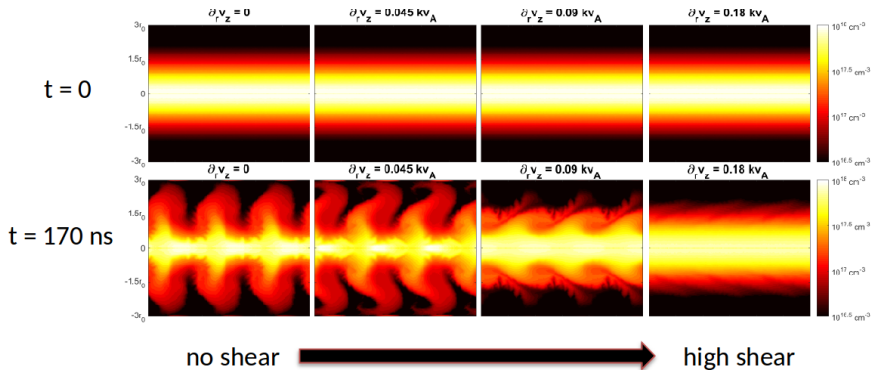
- ZaP and ZaP-HD (U. Shumlak *et al.*)
 - Verification of NIMROD neutral dynamics with Meier's HiFi calculations (plus PSI-TET???)
- PSI-Center personnel involved with Ebrahimi and Hooper's NSTX NIMROD simulations
- Exploring dynamic mode decomposition (DMD) for validation (Roy K. Taylor *et al.*, submitted for publication)

UW-LLNL ARPA-E ALPHA project (started Aug 2015)

- Higher current version of ZaP
- Operation with deuterium, neutron production (this fall)
- Extensive computational support
 - Uri Shumlak performs two-fluid simulations with WARP-X and Mach2
 - LLNL: Kurt Tummel, Drew Higginson, and Andréa Schmidt perform hybrid and full kinetic PIC simulations with Chicago/LSP (including neutron yield)
 - Initial kinetic runs show signatures of sheared-flow stabilization
 - Significant effort:
 - 1 summer month Shumlak
 - ~20% FTE (Higginson & Schmidt)
 - Full-time LLNL post-doc (Tummel)

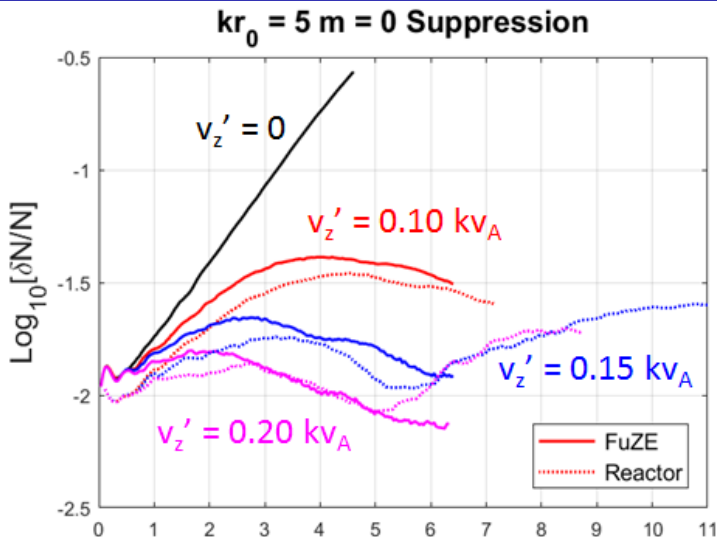
LSP/Chicago Kinetic Simulations Show Sheared-Flow Stabilization

Z-pinch n profiles with increasing shear (Kurt Tummel, Drew Higginson, and Andr ea Schmidt, LLNL)

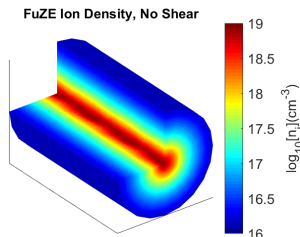


2D Kinetic Simulations Show Sheared-Flow Stabilization (cont.)

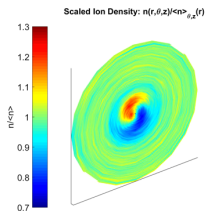
$m=0$ growth rate stabilized with sufficient flow shear



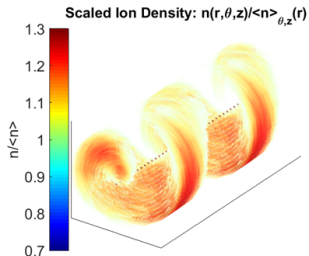
3D Kinetic Simulations Underway to Study $m=1$ Kink



Initial density profile



Slice showing positive and negative δn



Surface of developing $m=1$ kink

Summary and Future Work

- Collaborating experiments are being simulated and directly compared to experimental data (HIT-SI/HIT-SI3, HBT-EP, LTX- β , Pegasus, MPDX, TREX, and ZaP/ZaP-HD/FuZE)
- Validation metrics have been published (two publications)
 - Continue establishing BD validation metrics
 - Developing “dynamic mode decomposition” (DMD)
- Continue simulations of flow-shear stabilization (FuZE)
- Verify neutral physics in NIMROD and PSI-TET
 - Slab acceleration
 - Coaxial acceleration region