

Status and Plans of PSI-Center Collaborations

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PSI-Center Meeting 2015
Seattle WA
July 29–30, 2015

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Status of Collaborating Experiments

Experiment	Physics Studied	NIMROD	HiFi	PSI-Tet
Caltech	Co-planar helicity injection	✓✓		
CTH	Torsatron/tokamak hybrid (help with NimPy)	✓✓✓*		
ELF	FRC translation in neutrals	New	✓✓✓	
FRX-L	FRC translation/compression	✓✓	✓	
HBT-EP	Tokamak wall-stabilization			✓✓
HIT-II	ST coaxial helicity injection	✓✓✓		
HIT-SI	Current drive/relaxation	✓✓✓	✓✓	✓✓✓
HSX	Flux surface calculations			New
IPA & Venti	Colliding FRCs	✓✓✓		
LTX	Resistive wall currents & collisionality			✓✓
LDX	Curved, doubly-connected	✓✓		
MBX	3 cylinders	✓		
MST	High-energy particle effects	✓✓✓		
MAST	Compression startup		✓✓✓	
Pegasus	Solenoid-free startup	✓✓✓		
PHD	FRC translation/passive compression	✓✓	✓	
SSPX	Spheromak coaxial helicity injection	✓✓✓*		
SSX	Spheromak formation/relaxation	✓✓	✓✓✓	
TCS-U	RMF current drive in FRCs	✓✓✓	✓	
ZaP	Flow-shear stabilization	✓	✓✓✓	



Compared to experiment and/or continued study

Codes running for specific experimental geometry

General code runs of experimental interest performed

* Performed under other grants

- HBT-EP (C.J. Hansen and Columbia Group)
 - Wall stabilization
 - Feedback algorithms
 - Equilibrium fitting

- HIT-SI/HIT-SI3 (K.D. Morgan, C.J. Hansen, D.A. Sutherland, & T.R. Jarboe)
 - Quantitative comparison of NIMROD and PSI-Tri to experimental data
 - PSI-Tri equilibrium fitting
 - Neutral dynamics
 - Stability studies through DCON
 - BD validation metrics

Further Collaboration Work — II

- IPA & Venti (R.D. Milroy)
 - FRC merging and compression
 - Could incorporate thin resistive wall capability
- LTX (C.J. Hansen, E. Held, J.-Y. Ji, and PPPL???)
 - Low wall loading (lithium pumping)
 - Low collisionality regimes
 - Non-local 3D effects (asymmetric shell, gas puff, *etc.*)
 - Equilibrium fitting
- Pegasus (J. O'Bryan, C.R. Sovinec, & new student)
 - Non-solenoidal ST startup w/biased plasma sources (publication)
 - Carl's talk

Further Collaboration Work — III

- SSX (J. Egedal, Post-doc & M. Brown)
 - More HiFi studies
- ZaP (W. Lowrie, U. Shumlak, & S.D. Knecht)
 - HiFi simulations of “rod” (open) outer electrode
 - Verification of NIMROD neutral dynamics with Meier’s HiFi calculations (PSI-Tet???)
 - Comparison with experimental data (publication)
 - Conversion to ZaP-HD, further neutral dynamics (snowplow vs. deflagration)
 - Also want to finish NIMROD linear stability studies (Nelson)

UW-LLNL ARPA-E ALPHA project (starting ~ Aug 2015)

- Higher current version of ZaP
- Operation with deuterium, neutron production
- Extensive computational support
 - Uri Shumlak perform two-fluid simulations with WARP-X and Mach2
 - Andréa Schmidt perform hybrid and full kinetic PIC simulations with LSP (including neutron yield)
 - Significant effort:
 - 1 summer month Shumlak
 - ~20% FTE Schmidt
 - Full-time LLNL post-doc

- Collaborating experiments are being simulated and directly compared to experimental data
- Some simulation results:
 - NIMROD FRC simulations compared with TCS–U data (publication)
 - NIMROD HIT–SI simulations compared to data (publication)
 - Pegasus NIMROD simulations show relaxation activity and poloidal flux amplification (publication)
 - ZaP open-electrode configuration studied, compared to data (publication)
- Validation metrics have been published (two publications)

- Continue establishing validation metrics
- Continue simulations of flow-shear stabilization (ZaP); linear stability study
- Implement neutral physics in NIMROD
- Informal help with Hooper's NSTX NIMROD simulations
- Continued development of `NimPy` and other tools