

## NSTX PAC-25 Questions – Day 2

- We are pleased to see the level of theory and modeling that appears in your research program. However, we would like to understand better the interactions between the PPPL theory group and the NSTX Team.
- The NSTX FY08 run has several headline catching results. We want to know: what do you anticipate will be the four or five major results coming from the FY09 run?

# PPPL theory provides leading contributions in EP and T&T, complements collaborator contributions in other areas (1)

- Energetic particles
  - \*AE modes and impact on fast ion confinement
    - NOVA-K (N. Gorelenkov)
    - M3D-K (G.Y. Fu)
    - ORBIT (R. White)
    - HYM - non-linear (E. Belova)
- Transport
  - Non-local neoclassical transport
    - GTC-NEO (W. Wang, G. Rewoldt)
    - Code upgrades to include multi-ion species (W. Wang, R. Kolesnikov)
  - Turbulent energy and momentum transport (linear and non-linear gyrokinetic calculations)
    - GTS (W. Wang, S. Ethier)
    - GYRO (G. Hammett, J. Peterson – grad student, collaboration with GA)
    - GEM (G. Rewoldt, collaboration with S. Parker)
  - GAE-driven electron transport (N. Gorelenkov, R. White)

# PPPL theory provides leading contributions in EP and T&T, complements collaborator contributions in other areas (2)

- Macrostability
  - Kink stability analysis for high beta scenarios w/ PEST (J. Manickam)
  - Plasma response to applied fields/error fields
    - IPEC (J.K. Park, M. Chance), also CAS3D
    - M3D (J. Breslau)
- Boundary
  - ELM stability calcs with PEST (J. Manickam)
  - UEDGE modeling for LLD (D. Stotler)
  - Neutral transport and GPI interpretation
    - DEGAS2 (D. Stotler)
- Integrated scenario modeling, including ramp-up
  - Predictive TRANSP/TSC (R. Andre, D. McCune, C. Kessel)

# Some Hypothetical FY2009 Research Highlights...

- NSTX achieves significant advances in non-inductive sustainment & ramp-up
  - Li + high- $\kappa$ , high- $\beta_p$  scenario enables access to NICD fraction  $\sim 80\%$  at high  $\beta_N$
  - Improved fast-wave heating produces low- $I_p$  ( $\sim 300\text{kA}$ ) 100% NICD (transiently)
- NSTX observes electromagnetic effects important for electron transport
  - Link between GAE and core e-transport established, x-ray spectrometer measures fast electron transport from  $\mu$ -tearing, GAE, ...
- Fast particle contributions to RWM stability measured for first time
  - Kinetic stabilization effects strong in ST, and important for ITER burning plasmas
- Researchers controllably trigger edge modes to control edge confinement
  - Optimized mix of n-numbers,  $q_{95}$ , boundary shape, Li controls ELM size
- Improved start-up techniques important for ST developed on NSTX & DIII-D
  - NSTX: Improved CHI operation saves significant volt-seconds during ramp-up
  - DIII-D: high ECH power key to successful inductive ramp-up without solenoid
- Hopefully some surprising results we didn't anticipate!