

The Role of the MHD Experimental Task Group in NSTX FY02 Research

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NSTX Research Forum

MHD Experimental Task Group

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Research will be guided by upcoming Milestones



- FY02 Milestone (02-1)
 - Measure and analyze the global stability of ST plasmas at high β without applying active external control. (9/02)
 - Which modes limit β ?
 - Can we obtain a quantitative and/or predictive explanation of the limits?
 - Are there any ST-specific modifications to our understanding?
 - Begin to ask: Can the beta-limiting modes be actively stabilized?
 - Will NTMs and/or RWMs determine the limits of performance?
 - What role do error fields play in the stability of these (and other) modes
- FY03 Milestone (03-2)
 - Explore and characterize spherical torus plasmas simultaneously having high τ_E , high β , and high f_{BS} for durations $\gg \tau_E$ (9/03)
 - From stability stand-point, this means $I_p > 0.8\text{MA}$, $\beta_N=4-6$, $\beta_p = 0.6-0.8$
 - Results from MHD ET will strongly influence scenario development

Breakout agenda covers many MHD topical areas



- Fast Particle Driven Modes
 - Gorelenkov, Fredrickson, Bernabei, Heidbrink
- ELM Stability
 - Snyder, Bush
- Tearing Modes, Error fields
 - Menard, Gates, Bell, Takahashi
- Kink and Resistive Wall Modes, Plasma Shaping
 - Sabbagh, Okabayashi, Manickam, Gates, Kaye
- Discussion
 - Research strategy based on physics, diagnostics, run-time, etc.
- Several DIII-D similarity XPs: Heidbrink, Snyder, Sabbagh

Some MHD questions we can hope to address



- Fast Particle Driven Modes
 - Can we expect to see CAEs above Ω_D , and with what spectrum?
 - Can high- β , high T_i - T_e discharges exist with weak CAEs?
 - What is the TAE/EPM/fishbone in NSTX, and is it harmful?
 - How does the TAE in NSTX compare to higher-A tokamaks?
- ELM Stability
 - What triggers ELMs in NSTX - pressure, current, both?
 - Is the ELM ballooning or kink like - is there is difference?
 - Are resistivity, diamagnetism, and other kinetic effects important?
 - Can ELMs be avoided, and how does H-mode affect β -limits?

Even more MHD questions we can hope to address



- Tearing Modes, Error fields
 - What role do tearing/kink modes play in low- I_i discharges?
 - NBI-driven rotation appears crucial to high- β - why, how much is needed?
 - Will NTMs in NSTX be modified by machine improvements?
 - Can we use sawteeth as an NTM seed to study threshold physics?
 - What role might current in the SOL play in stability
- Kink and Resistive Wall Modes, Plasma Shaping
 - What is the role of the RWM in NSTX, when is it unstable?
 - Can we see the RWM rotate (rather than lock to error field)?
 - How do the internal and external kink modes couple?
 - How will BS and PS current modify the external kink?
 - How much does triangularity modify β limits?
 - Can we modify the near-edge mode stability with PF4?

Summary



- Many research ideas will be presented and discussed
 - Overlap in some proposals is expected, keeps forum interesting
 - Some overlap between ETs is also apparent
- Machine improvements should improve performance
 - Many experiments are counting on error field reduction
 - Getting this done ASAP cannot be over-emphasized
 - H-mode improvement from bake-out also very important
- Expect another productive year from MHD Task Group
 - Run planning will need to incorporate MHD diagnostic status:
 - Nearly all internal sensors replaced last outage, need re-calibration
 - Locked-mode sensors need to be re-calibrated once PF5 is moved