Overview of MHD ET Results for FY02

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NSTX FY02 Results Review

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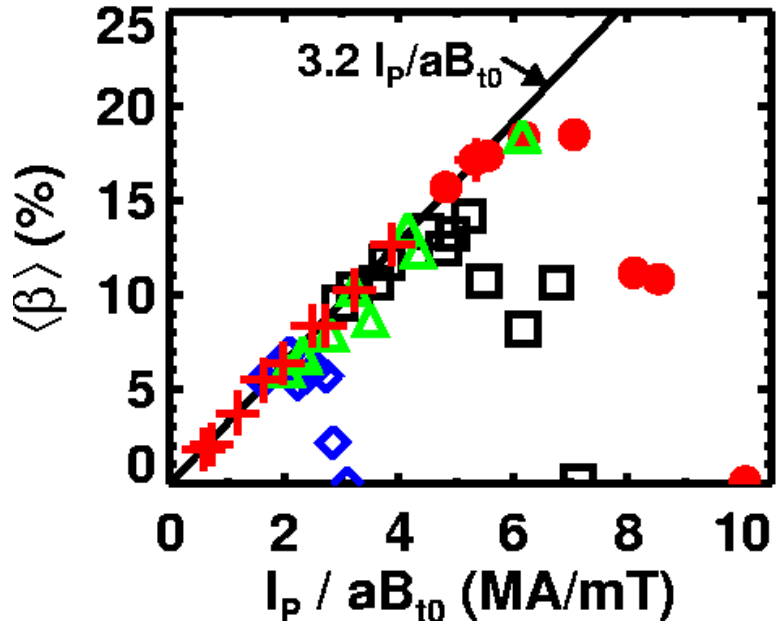
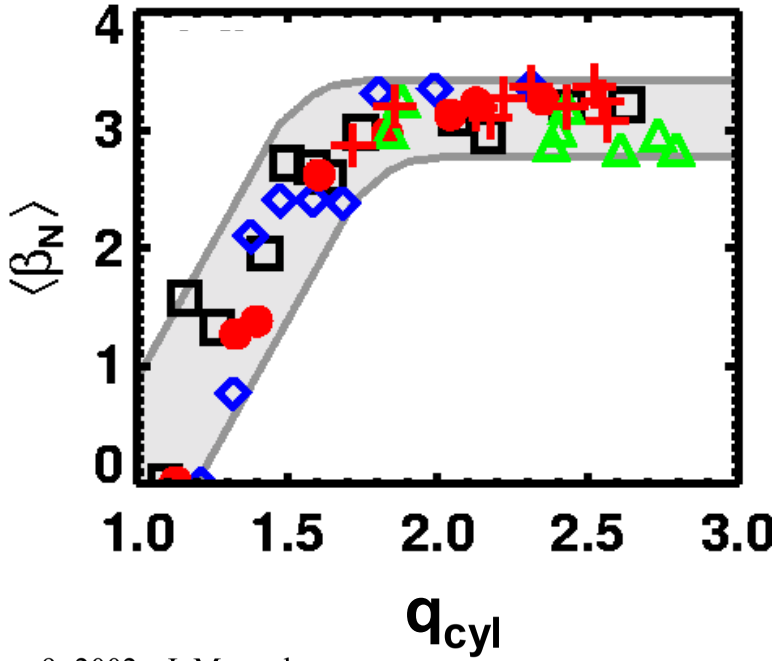
8 MHD XPs received run time

- MHD-ET group experiments from FY2002:
  - XP038 - High Triangularity at High Beta - ***D.Gates***
  - XP201 - Alfven Mode Similarity with DIII-D - ***W. Heidbrink***
  - XP202 - Characterization of the RWM in the ST - ***S. Sabbagh***
  - XP207 - Impact of error-field reduction on NSTX LSN discharges - ***J. Menard***
  - XP208 - Study of stability boundaries for CAE modes - ***E. Fredrickson***
  - XP216 - The role of int. and ext. components in kink modes - ***J. Manickam***
  - XP219 - Investigation of Diamagnetic Plasmas in the Spherical Torus – ***S. Sabbagh***
  - XP221 - Tearing & kink stability of low-li plasmas with reduced EF - ***J. Menard***
- Publications in-prep related to MHD results
  - IAEA FEC2002, Nuclear Fusion (Menard, Sabbagh)
  - APS DPP02, Physics of Plasmas (Gates)
- Many publication quality results obtained this run

Recent theory work on global stability:

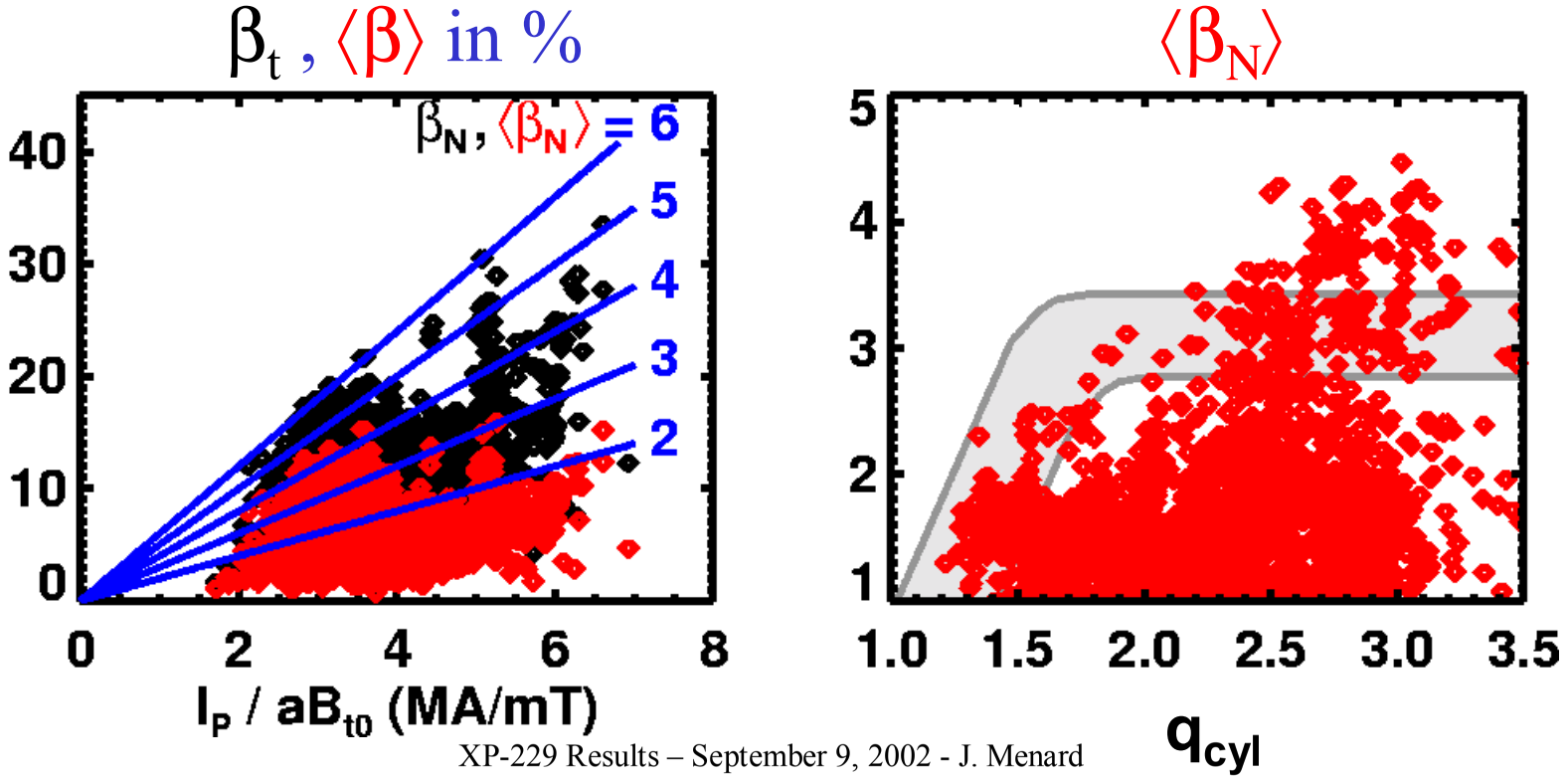
- Finds $\langle\beta_N\rangle$ and q_{cyl} best describe no-wall limits across aspect ratio and shape – includes scans for:
  - Scan A=1.25-10, fixed f_{BS}=50%, κ=2, δ=0.45
  - Scan κ=1.6-2.5, δ=0.3-0.6, fixed A=1.6, f_{BS}=50%
  - Scan f_{BS}=0-0.6, fixed A=1.6, κ=2,2.5, δ=0.45,0.6, and A=3.3, κ=2, δ=0.45



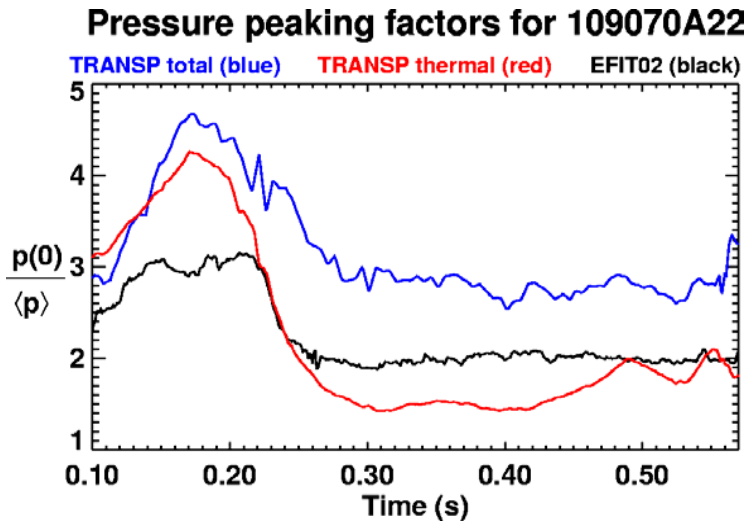


NSTX above *optimized* no-wall limit for $q_{cyl} > 2$

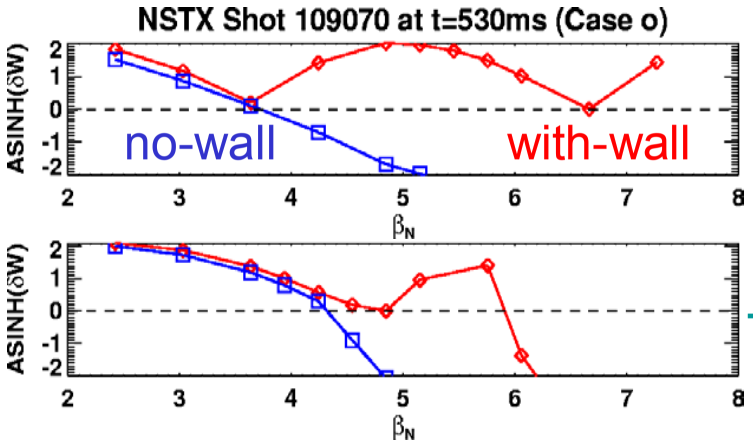
- **Have achieved: $\beta_t = 34\%$, $\beta_N > 6$, $\langle\beta_N\rangle > 4$**
- NSTX exhibits current limit behavior for $q_{cyl} < 1.7$
  - But, need to revist lower q_{cyl} β-limits in future runs
- **Need to push $\langle\beta_N\rangle > 4$ regime to higher I_P, lower q_{cyl}**



Role of NBI will dominate future research



Marginal stability calculations:



- Beams predicted to increase pressure peaking
  - *Impact on equilibrium and global stability predictions*
  - ***Need fast particle profiles***
- Impact of *rotation* and *rotational shear* on internal kink, RWM, and tearing
- TAE/fishbone can lead to neutron rate drops
- Cross-machine XPs started
- Heating anomaly reduced with improved MPTS, so…
  - *Is CAE heating (still) active?*

MHD Results Agenda

- 2:35 The Resistive Wall Mode and Global Mode Stability Limits in NSTX - *S. Sabbagh*
- 2:55 VALEN Analysis of NSTX RWM Structure - *J. Bialek*
- 3:15 - *break* –
- 3:30 M3D Simulations of NSTX - *W. Park*
- 3:50 MHD equilibrium with rotation - *Guazzotto*
- 4:10 Beam Voltage Threshold for Excitation of CAE modes - *E. Fredrickson*
- 4:30 Alfvén Mode Similarity Experiments between NSTX and DIII-D - *W. Heidbrink*
- 4:50 Bounce Frequency Fishbone Analysis - *R. White*
- 5:10 Sub-cyclotron Alfvén Instability in Spherical Tokamak…. - *N. Gorelenkov*
- 5:30 Numerical Study of Instabilities Driven by the Energetic NBI in NSTX - *E. Belova*