MHD Experimental Task Group Planning Session

S. A. Sabbagh

Columbia University

D. A. Gates

Princeton Plasma Physics Laboratory

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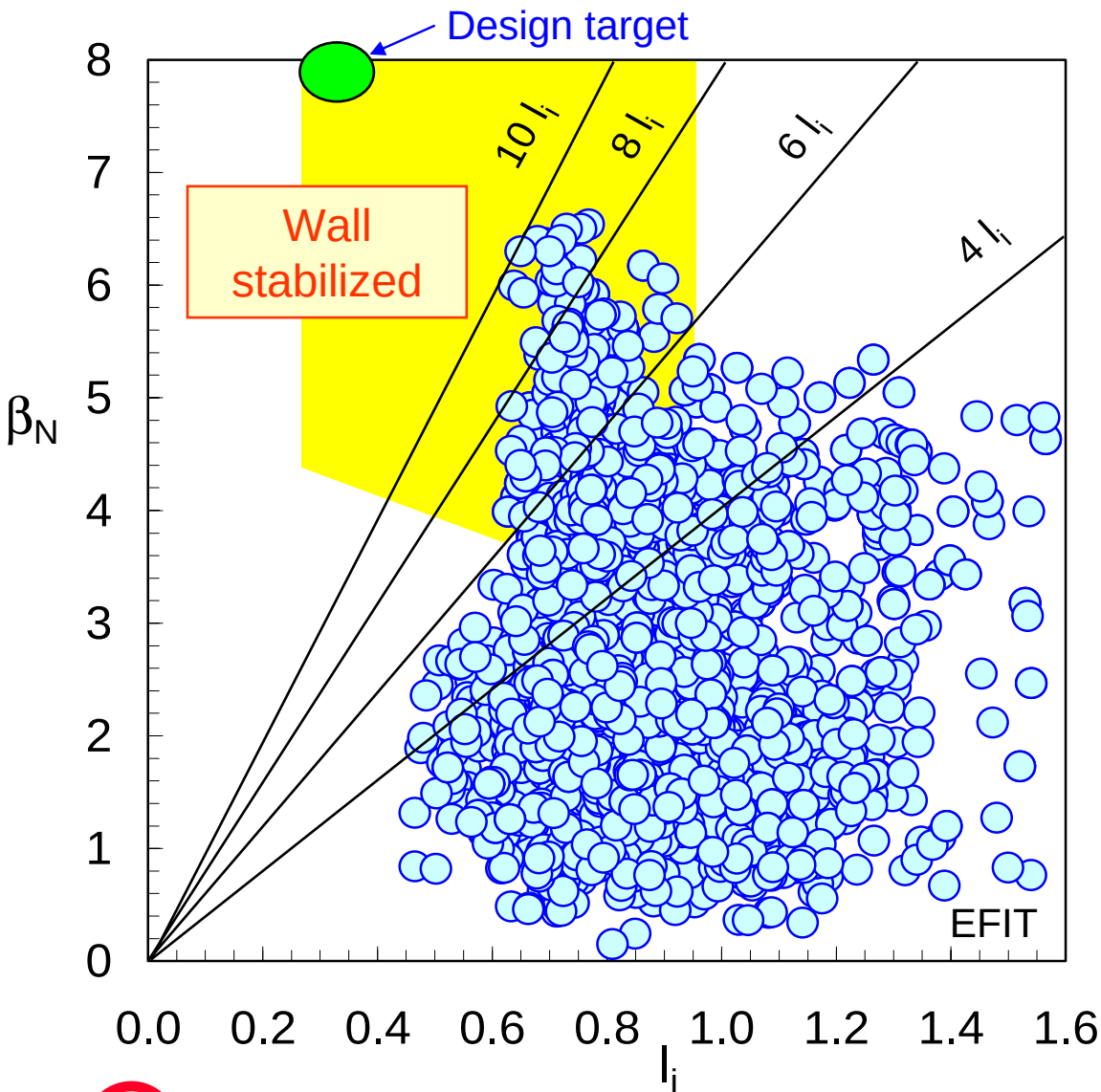
Princeton Plasma Physics Laboratory

CY04 MHD research guided by NSTX 5 Year Plan

- Research goals from 5 Year Plan
  - Role of equilibrium variation on global stability
    - Optimize boundary/profiles for highest stability limit and pulse duration
  - Resistive wall mode physics
    - Measure/study flow damping; dissipation mechanism; mode structure
  - Neoclassical tearing mode physics
    - Seeding mechanisms; instability thresholds; mode effects and stabilization
  - Fast ion MHD
    - *AE mode thresholds/structure; effect on fast ion confinement; compare to theory
  - Influence of rotation on equilibrium and stability
    - Equilibrium/stability modification; dependence on aspect ratio; etc.
  - Error fields and locked modes
    - Measure/correct error fields; study low beta locked mode density limit, etc.
  - Active resistive wall mode stabilization
    - Dynamic error field reduction; rotation braking; MHD spectroscopy
  - Edge localized mode physics
- Experiments comparing devices, supporting ITPA goals, utilizing NSTX specific capabilities are encouraged

NSTX plasmas operate in wall-stabilized space



- Normalized beta, β_N = 6.5, with β_N/l_i > 9.5
- β_N up to 35% over $\beta_{N\ no\text{-}wall}$ (computed using DCON)
- Toroidal beta has reached 35% ($\beta_t = 2\mu_0 \langle p \rangle / B_0^2$)

Run Plan and Machine Capability Guidance CY 2004

- Run time constraints
  - 18 run weeks divided by six experimental task groups
    - allowance for contingency time and machine enabling time
  - MHD ET slated to have 11 run days out of 18 run weeks
  - The 11 run days does *not* include our contingency allotment
    - estimated 2 - 3 contingency run days for MHD ET
- Machine capability
  - Maximum allowed toroidal field increases in time
    - Day 1: 3.5 kG; Week 4: 4.5 kG; Week 12: 5.5 kG
  - Active mode control coil available in second half of run
    - fast power supply uncertain; plan assuming it will be available
    - active feedback control unlikely in CY04

Scheduled MHD Presentations and Discussions

- Presentations
  - Troyon scaling at high normalized current (Gates)
  - Effect of boundary shape on plasma stability (Kaye)
  - RWM discrimination from ELMS, noise, etc. (Edgell)
  - Dissipation physics of the RWM (Sontag)
  - DIII-D/NSTX RWM physics similarity XP (Sontag)
  - Passive stabilization physics of the RWM: XP313 (Sabbagh)
  - Active RWM control physics (Sabbagh)
  - Collective fast ion loss scaling (Fredrickson)
  - External kink and control of RWM (Fredrickson)
  - Rotation damping physics in high β_N ST plasmas: XP314 (Zhu)
  - Hypervelocity dust beam to measure B direction profile (Wurden)
  - Aspect ratio effects near the high β_p equilibrium limit (Sabbagh)
  - Suppression of chirping in beam-driven instabilities (Heidbrink)
  - Vertical instability and control (Kessel)
  - Status and plans for USXR systems on NSTX (Tritz)
  - Faraday rotation diagnostic for J and δB Measurements (Brower)
  - Toroidal field measurement and MHD studies with FIReTIP (Lee)
- MHD XP priority discussion (our product is a prioritized run plan!)