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Discussion of NSTX Contributions to ITER-ITPA: Macroscopic Stability

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Macroscopic Stability Topical Science Group

NSTX ITER/ITPA Discussion Meeting
September 29th, 2008

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NSTX Macro TSG Met to Address Contributions to ITER/ITPA

- Actions for Meeting (9/24/08)
  - Discuss topics – experimental / theoretical / modeling perspectives
  - Suggest priority given resources
  - Identify personnel as responsible NSTX contacts

- Address Program Director's Questions
  - "Which ITER and ITPA high priority areas should NSTX focus on?"
  - "Which joint experiments should NSTX contribute to or lead?"
  - "Should any new joint experiments be initiated?"
  - "Are there joint experiments that should be discontinued?"

Which ITER/ITPA High-priority Topics Should Macro Focus On?

(Parallels recent guidance by ITPA MHD group leader, A. Sen)

- Disruption characteristics, mitigation
  - Halo currents, peaking; power deposition, vessel forces, runaways (possible?)
    - Understand effect of disruptions(+ ELMS?) on divertor/first wall ('09 XP by SPG)
    - ??Interest in joint disruption modeling effort (NIMROD/M3D, halo currents; EU has program)
  - ??Future: possible use of CT injection for mitigation (Raman, et al.)
- Disruption avoidance: plasma and mode control
  - Plasma control requirements (vertical stability, shape, position) – joint w/ ISO?
    - Magnetic Diagnostics for ITER (SPG mentioned interest by JEM)
  - NTM mitigation, avoidance of mode locking, role of error fields
  - RWM active control – focus on low V_ϕ?; future: non-magnetic diagnostics
  - Resonant field amplification, multi-mode EF reduction, IPEC vs. vacuum
  - ??ELM control (NTM/RWM seeding?, effect on V_ϕ, joint w/ boundary group)
  - Rotation damping; control
    - Effects of 3-D fields/modes (NTV vs. δB, collisionality; ExB, etc.)
- Mode physics and stabilization
  - NTM stability physics vs. A, marginal island width, ρ^* effects, V_ϕ, V_ϕ shear
  - RWM stabilization physics – V_ϕ, collisionality, q; focus on low V_ϕ?

Which Joint Experiments should Macrostability address/lead?

(S. Kaye suggests 20-30% XPs involve some ITER support; better future follow-up)

- MHD group

  NSTX contact identified

  - MDC-2: Joint Experiments on RWM Physics (SAS)
  - MDC-4: NTM Physics – aspect ratio comparison (EF => SPG, EF?)
  - ??MDC-5: Comparison of sawtooth control methods for NTM suppression (SPG)
  - MDC-12: Non-resonant magnetic braking (SAS)
  - MDC-13: Vertical stability physics and performance limits in highly elongated plasmas (DG => DG, SAS?)
  - MDC-14: V_ϕ effects on NTMs (SAS => SPG?)

- Potential new joint experiments

  (No joint XPs suggested to be closed, led)

  - Define one (or more) on stability aspects of hybrid operation
    - ??Effects of NTMs, ELMs, RWMs in Hybrid Scenarios, effect of plasma rotation, ν^*
    - Note: Steady-State Operations has two joint XPs with potential overlap
      - SSO-2.2: MHD in hybrid scenarios and effects on q-profile (Kessel); also
      - SSO-2.3: Rho* dependence on confinement/stability in hybrid scenarios
  - ??Possible joint XP on stability aspects of long pulse discharge reliability
    - Reliability aspect would make this distinct from aforementioned joint XP