

Macroscopic Stability TSG 2010 FY11-12 Milestone Discussion

S.A. Sabbagh
Columbia University

J.E. Menard, J.-K. Park
PPPL

NSTX Macroscopic Stability Topical Science
Group

Macro Stability TSG Meeting

November 23rd, 2010
Princeton Plasma Physics Laboratory

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FY11-12 Milestone Discussion – Meeting Purpose

- ❑ Purpose: Brief TSG-level discussion of milestones ahead of full team meeting on 12/6/10

- ❑ Outline
 - ❑ General Comments/Suggestions Regarding Milestones

 - ❑ Brief Summary of Present Milestones
 - Group input on Macro-stability related milestones as desired

 - ❑ Suggested Actions
 - Formulate suggestions on general statement / categorization of milestones, and on detail of milestone statement as desired
 - Complete discussion by email iteration as needed/desired

NSTX Milestones – General Comments / Suggested Actions

❑ Many Recent Milestones are Cross-disciplinary

- ❑ Natural for modern fusion research

- E.g. similar situation for many areas of ITPA research

- ❑ ACTION: Suggest that milestones no longer map uniquely to topical science groups

- Define milestones by number (as usual)

- Define participating TSGs in timeline charts, rather than making each milestone a unique line-item for each TSG

❑ Some key details should be updated

- ❑ Use of LLD for low collisionality?

- ❑ Use of HHFW to support low rotation and high beta?

- ❑ RWM state space controller now available – update milestones to reflect this

- ❑ Real-time rotation measurement still targeted for FY11?

- ❑ Real-time rotation control still targeted for FY11?

FY11 Milestones – Brief characterization for group discussion

- ❑ R(11-1): Measure fluctuations responsible for turbulent ion and electron transport
 - ❑ Dedicated T&T TSG milestone
- ❑ R(11-2): Assess the dependence of integrated plasma performance on collisionality
 - ❑ ASC TSG – suggest to strengthen Macro-stability TSG component
 - ❑ Emphasis on HHFW and LLD – ASC group plans to change this; suggest changes be combined with updated Macro-stability elements
 - Develop low collisionality target using SGI; new LITER / LLD scenarios?
- ❑ R(11-3): Assess the relationship between lithiated surface conditions and edge and core plasma conditions
 - ❑ Dedicated LRTSG milestone
- ❑ IR(11-1): Assess RWM and rotation damping physics at reduced collisionality
 - ❑ Strong Macro TSG elements, ITPA MHD group, suggest update based on 2010 data/analysis and promotion to standard (non-incremental) milestone
- ❑ IR(11-2) Assess pedestal and SOL response to externally applied 3D fields
 - ❑ Stability response to 3D fields, broaden to include greater Macro TSG input?

FY12 Milestones – Brief characterization for group discussion

- ❑ R(12-1): Enhance physics understanding of turbulent transport mechanisms by comparing theory and simulation to measured fluctuations
 - ❑ Dedicated T&T TSG milestone
- ❑ R(12-2): Assess very high flux expansion divertor operation
 - ❑ Strengthen Macro-stability connection by examining differences in stability and active $n = 1$ control in these configurations?
- ❑ R(12-3): Assess confinement, heating, and ramp-up of CHI start-up plasmas
 - ❑ Dedicated SFSU TSG milestone
- ❑ R(12-4): Investigate magnetic braking physics and develop toroidal rotation control at low collisionality
 - ❑ Update to be consistent with 2010 results, FY11 milestones, may need to alter tools for low ν (SGI?), rotation control in FY2012? Joint ASC/Macro.
- ❑ IR(12-1): Assess predictive capability of mode-induced fast-ion transport
 - ❑ WEP TSG milestone, but recent Macro-stability research shows that fast ion population effects global stability – increase ties to Macro-stability TSG research needs

Do we need to significantly alter milestones / add a new Macro-stability TSG milestone?

□ ST Community Needs

- Global stability adequately covered by milestones IR(11-1), R(12-4)?
- Rotation control via magnetic field is an important area of research supporting stability needs that is covered by these milestones
- Suggest to update milestones to reflect need for disruption probability and physics-based reduction of disruption onset

□ ITPA Needs

- Newly redefined ITPA MDC-2 to benchmark RWM stability codes including energetic particles and rotation effects is covered by present milestones
- RWM state space control including influence of conducting structures can be covered up present milestones with fairly minor updates
- Need for more specific mention of halo current alteration / mitigation?
- Need for specific locked mode physics explicitly in milestones?