NSTX

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Summary of Macroscopic Stability TSG FY11-FY12 Forum XP Prioritization

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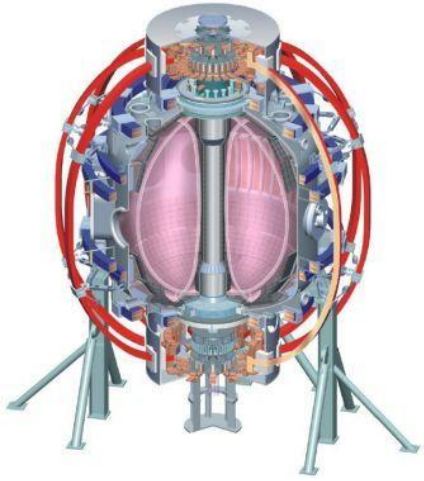
Jack Berkery (TSG Deputy Leader),
Jong-Kyu Park (TSG Leader),
Riccardo Betti (TSG Theory Leader)

NSTX FY11-FY12 Research Forum
B318, PPPL
March 15-18, 2011



Culham Sci Ctr
U St. Andrews
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POSTECH
ASIPP
ENEA, Frascati
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IPP, Jülich
IPP, Garching
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Twenty proposal received covering NSTX milestones and ITPA activities

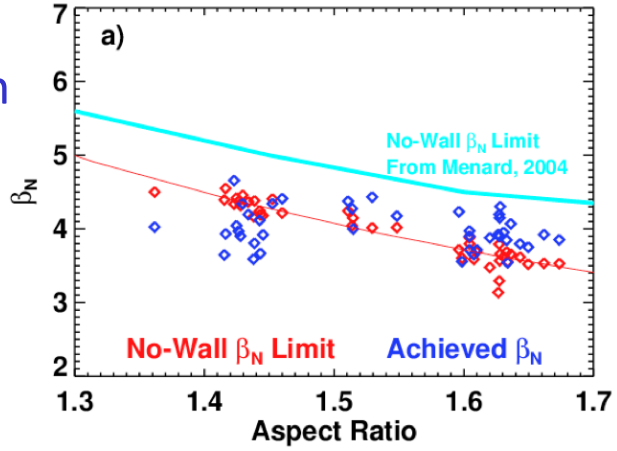
- Milestones :
  - **R(11-2) : Assess ST stability dependence on plasma aspect ratio and boundary shaping**
  - R(12-3) : Assess access to reduced density and collisionality in high-performance scenarios (Main responsibility to ASC)
  - IR(12-1) : Investigate magnetic braking physics and develop toroidal rotation control at low collisionality
- ITPA activities :
  - MDC-2, WG-7: Resistive wall mode physics
  - MDC-4, MDC-14, WG-9: EF, Locking and tearing mode physics
  - MDC-12: Magnetic braking physics
  - MDC-15, MDC-17: Disruption physics
- 20 proposals requested 23.5 days
  - FY11 : 7 days = 5.5 days (1^{st}) + 1.5 days (2^{nd})
  - FY12 : 4.5 days = 3.5 days (1^{st}) + 1.0 days (2^{nd})

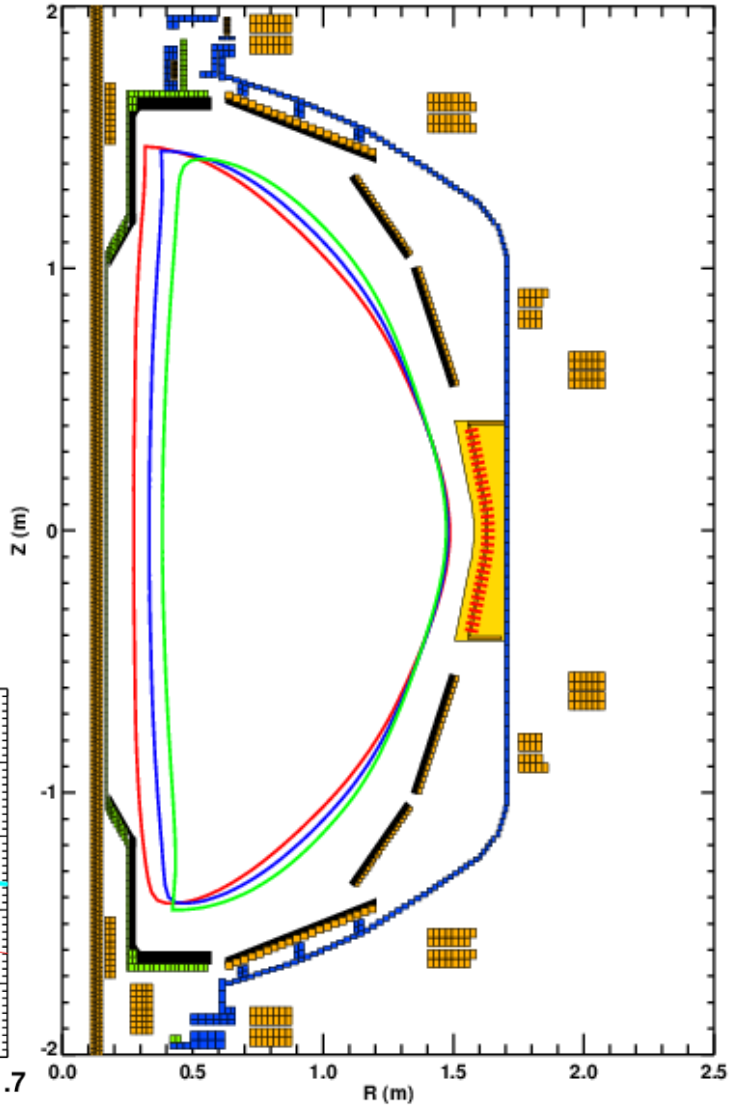
Macroscopic Stability TSG XPs: as proposed

Proposal title	Presenter	Days	Min.
• Influence of q profile on Tear. Mode Beta Limit and 3D Field Sensitivity	(R. J. Buttery)	3.0	1.5
• Error Field Threshold Study with Reduced Input Torques	(J.-K. Park)	1.0	0.5
• High-n stability test using RFA	(J.-K. Park)	1.0	0.5
• The later error field correction including plasma response	(J.-K. Park)	1.0	0.5
• Physics of early error field corr. in reduced-density adv. scenarios	(J. E. Menard)	1.5	0.5
• Role of kinetic dissipation in modifying RWM eigenfunctions	(J. E. Menard)	1.5	0.5
• Neoclassical toroidal viscosity at reduced collisionality	(S. A. Sabbagh)	1.0	0.5
• NTV steady-state offset vel. at red. torque with HHFW (XP1062)	(S. A. Sabbagh)	1.0	1.0
• RWM stab. control, NTV rot. alteration of higher A targets	(S. A. Sabbagh)	1.5	1.0
• RWM state space control physics	(S. A. Sabbagh)	1.0	1.0
• RWM state space active control at reduced plasma rotation	(Y. S. Park)	1.0	1.0
• RWM control physics with partial control coil coverage	(Y. S. Park)	1.0	1.0
• RWM Stabilization Physics at Reduced Collisionality	(J. W. Berkery)	1.0	0.5
• RWM Stabilization Dependence on Energetic Particle Distribution	(J. W. Berkery)	1.0	0.5
• Comparison of private flux region gas inj. vs midplane gas inj.in reducing divertor heat loads and halo currents during disruptions in NSTX	(R. Raman)	2.0	0.5
• Experimental Study of Disruption Heat Loading and Halo Currents	(S. P. Gerhardt)	1.0	0.5
• Test of ideal MHD stability as a function of A and elongation	(S. P. Gerhardt)	1.0	0.5
• MHD stability at Low-A and high normalized current	(S. P. Gerhardt)	1.0	0.5
• Opt. of early heat. and ramp rate to achieve stable op. at red. den.	(S. P. Gerhardt)	1.0	0.5
Total 11.5 days		23.5	13.0

Several XPs are in direct support of R11-2 milestone

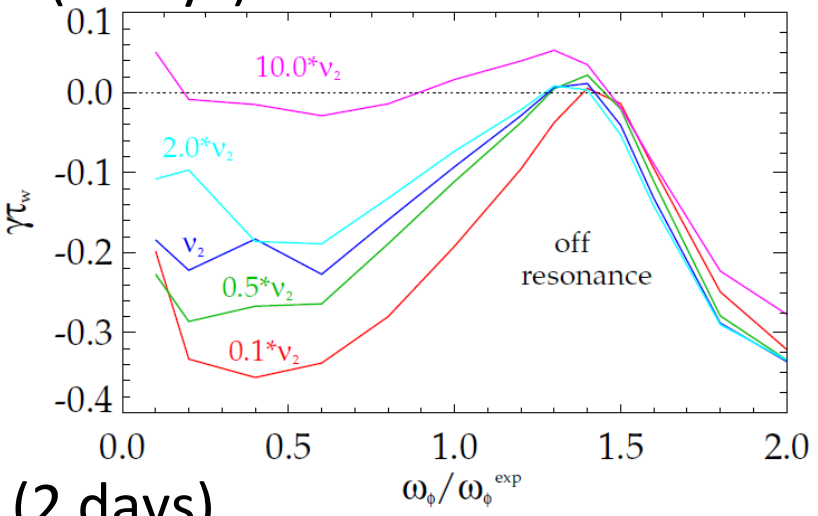
- Milestone R11-2: Assess ST stability dependence on plasma aspect ratio and boundary shaping (2.5 days)
  - Test of ideal MHD stability as a function of aspect ratio and elongation
    - S.P. Gerhardt 1.0 days
  - RWM stabilization control, NTV rotation alteration of higher aspect ratio ST targets
    - S.A. Sabbagh 1.0 days
  - MHD stability at low aspect ratio and high normalized current
    - S.P. Gerhardt 0.5 days



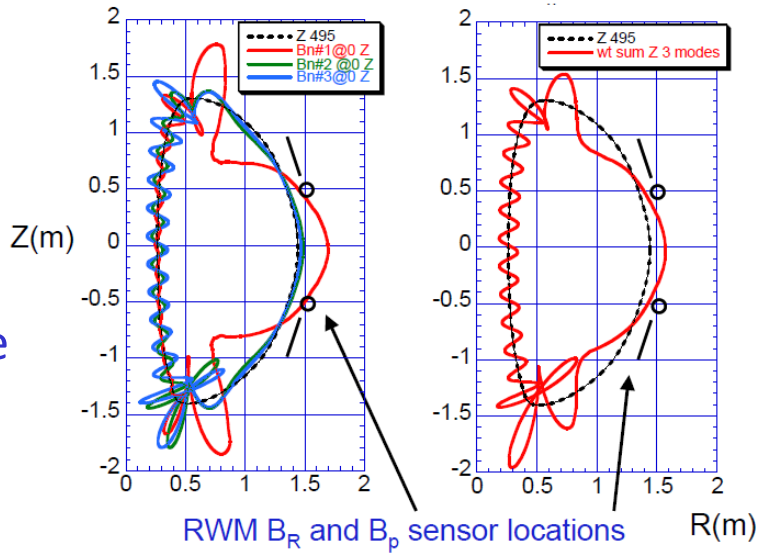


Resistive wall mode research is well represented

- Resistive wall mode passive stabilization (2 days)
  - RWM stabilization dependence on EP dist.
    - J.W. Berkery 0.5 days
  - RWM stabilization physics at reduced ν
    - J.W. Berkery 1.0 days
  - Role of kinetic diss. in modifying RWM ξ
    - J.E. Menard 0.5 days

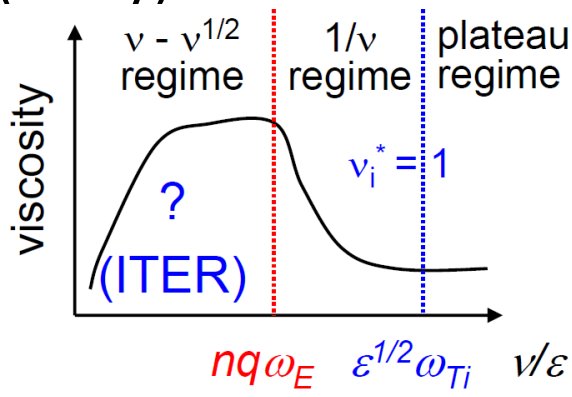


- Resistive wall mode active stabilization (2 days)
  - RWM state space control physics
    - S.A. Sabbagh 1.0 days
  - RWM s.s. active control physics at reduced ω_ϕ
    - Y.S. Park 0.5 days
  - RWM control physics with partial coil coverage
    - Y.S. Park 0.5 days

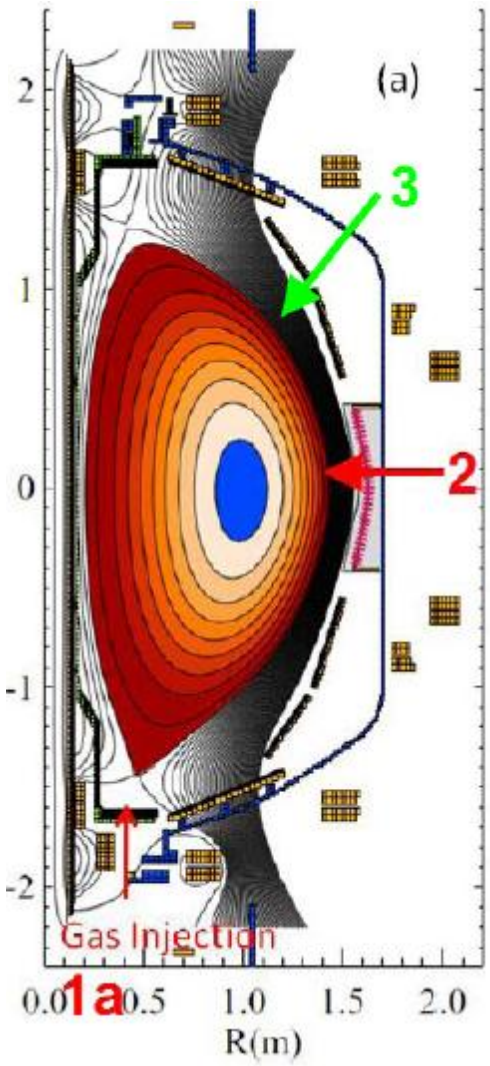


Several XPs cover NTV and disruption physics

- Neoclassical toroidal viscosity (1 day)
  - NTV at reduced collisionality
    - S.A. Sabbagh 0.5 days
  - NTV steady-state offset velocity at reduced torque with HHFW
    - S.A. Sabbagh 0.5 days

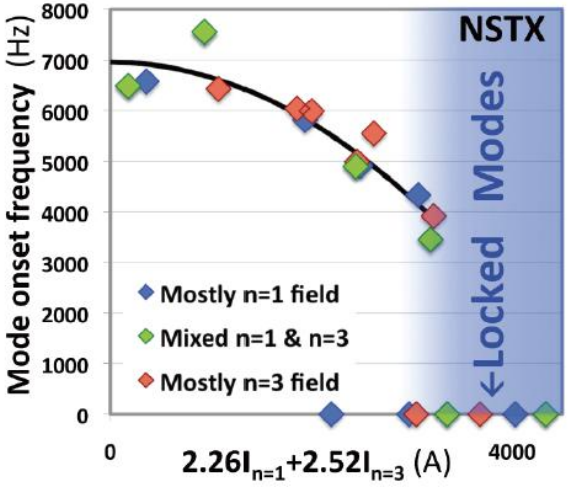


- Disruptions (1.5 days)
  - Comparison of private flux region gas inj. vs. midplane gas inj. in reducing divertor heat loads and halo currents during disruptions
    - R. Raman 1.0 days
  - Experimental study of disruption heat loading and halo currents
    - A. McLean 0.5 days

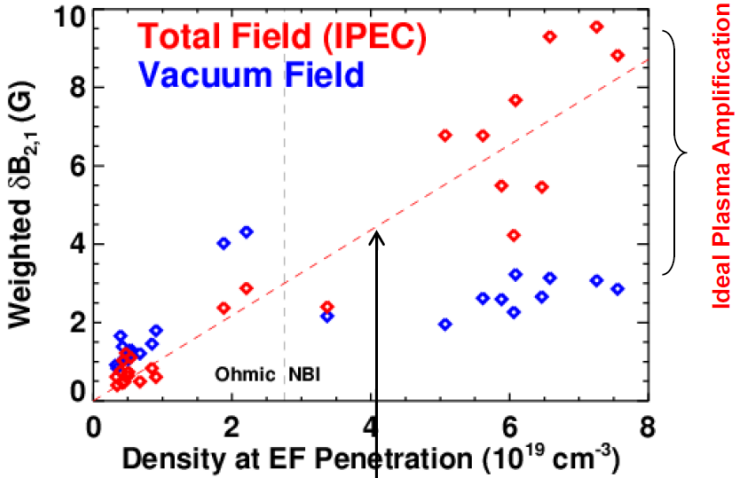


Error field, tearing mode, RFA XPs were combined into a few joint XPs

- Error fields, tearing modes and resonant field amplification (2.5 days)
  - Influence of q profile on tearing mode beta limit and 3D field sensitivity + Error field threshold study with reduced input torques
    - R. Buttery and J.-K. Park (combined) 1.0 days
  - Physics of early EFC in reduced density advanced scenarios + Later EFC including plasma response
    - J.E. Menard and J.-K. Park (combined) 1.0 days
  - High n stability test using RFA
    - J.-K. Park 0.5 days



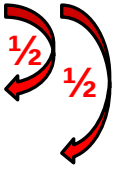
- Other
  - Optimization of early heating and ramp rate to achieve stable operation at reduced density
    - S.P. Gerhardt (1.0 days) -> Cross cutting
  - XMP for upgrades to the β_N controller
    - S.P. Gerhardt (0.3 days)



MS TSG achieved run time for each proposal within the correct total priority 1 + 2 guidance

#	Title	Proposer	Request	Minimum	FY-11 1st	FY-11 2nd	FY-12 1st	FY-12 2nd
1	Test of ideal MHD stability as a function of A and elongation	Gerhardt	1	0.5	1	0	0	0
2	MHD stability at Low-A and high normalized current	Gerhardt	1	0.5	0	0	0	0.5
3	Opt. of early heat. and ramp rate to achieve stable op. at red. den.	Gerhardt	1	0.5	0	0	0	0
4	Role of kinetic dissipation in modifying RWM eigenfunctions	Menard	1.5	0.5	0	0	0.5	0
5	RWM stab. control, NTV rot. alteration of higher A targets	Sabbagh	1.5	1	1	0	0	0
6	RWM state space control physics	Sabbagh	1	1	1	0	0	0
7	RWM state space active control at reduced plasma rotation	YSpark	1	1	0.5	0	0	0
8	RWM control physics with partial control coil coverage	YSpark	1	1	0	0	0.5	0
9	RWM Stabilization Physics at Reduced Collisionality	Berkery	1	0.5	0	0	1	0
10	RWM Stabilization Dependence on Energetic Particle Distribution	Berkery	1	0.5	0	0	0.5	0
11	Neoclassical toroidal viscosity at reduced collisionality	Sabbagh	1	0.5	0	0	0.5	0
12	NTV steady-state offset vel. at red. torque with HHFW (XP1062)	Sabbagh	1	1	0	0	0.5	0
13	Comparison of different gas inj. in reducing divertor heat loads	Raman	2	0.5	0	0	0.5	0.5
14	Experimental Study of Disruption Heat Loading and Halo Currents	Maclean	1	0.5	0	0	0	0.5
15	Disruptions, eddy currents, tile damage, Hiro currents, LLD	Zakharov	0	0	0	0	0	0
16	Influence of q profile on TM Beta Limit and 3D Field Sensitivity	Buttery	3	1.5	1	0	0	0
17	Physics of early EFC in reduced-density adv. scenarios	Menard	1.5	0.5	0.5	0	0	0
18	Later EFC including plasma response	JKPark	1	0.5	0.5	0	0	0
19	Error Field Threshold Study with Reduced Input Torques	JKPark	1	0.5	0	0	0	0
20	High-n stability test using RFA	JKPark	1	0.5	0	0.5	0	0
		TOTALS:	23.5	13	5.5	0.5	4	1.5
				Guidance:	5.5	1.5	3.5	1

	Guidance	Achieved
FY11 (1st)	5.5	5.5
FY11 (2nd)	1.5	0.5
FY12 (1st)	3.5	4.0
FY12 (2nd)	1.0	1.5



- Macroscopic Stability TSG backloaded 1 day from FY11 to FY12
  - 0.5 days FY11 (2nd) to FY12 (2nd)
  - 0.5 days FY11 (2nd) to FY12 (1st)

Extra Slides

MS TSG Agenda
(1:30~5:30pm, Wednesday, B318)

Approx. time	Proposal title	Presenter	Requested days
1:30	Influence of q profile on Tear. Mode Beta Limit and 3D Field Sensitivity	(R. J. Buttery)	3.0(1.5)
1:40	Error Field Threshold Study with Reduced Input Torques	(J.-K. Park)	1.0(0.5)
	High-n stability test using RFA	(J.-K. Park)	1.0(0.5)
	The later error field correction including plasma response	(J.-K. Park)	0.5 + 1.0(0.5)
	Physics of early error field corr. in reduced-density adv. scenarios	(J. E. Menard)	1.5(0.5)
2:00	Neoclassical toroidal viscosity at reduced collisionality	(S. A. Sabbagh)	1.0(0.5)
	NTV steady-state offset vel. at red. torque with HHFW (XP1062)	(S. A. Sabbagh)	1.0(1.0)
	RWM stab. control, NTV rot. alteration of higher A targets	(S. A. Sabbagh)	1.5(1.0)
	RWM state space control physics	(S. A. Sabbagh)	1.0(1.0)
2:20	RWM state space active control at reduced plasma rotation	(Y. S. Park)	1.0(1.0)
	RWM control physics with partial control coil coverage	(Y. S. Park)	1.0(1.0)
2:35	RWM Stabilization Physics at Reduced Collisionality	(J. W. Berkery)	1.0(0.5)
	RWM Stabilization Dependence on Energetic Particle Distribution	(J. W. Berkery)	1.0(0.5)
2:50	Role of kinetic dissipation in modifying RWM eigenfunctions	(J. E. Menard)	1.5(0.5)
3:00	Disruptions, eddy currents, tile damage, Hiro currents, grounding of LLD	(L. E. Zakharov)	0.0(0.0)
3:10	Comparison of private flux region gas inj. vs midplane gas inj. in reducing divertor heat loads and halo currents during disruptions in NSTX	(R. Raman)	2.0(0.5)
3:20	Experimental Study of Disruption Heat Loading and Halo Currents	(A. Maclean)	1.0(0.5)
	XMP for upgrades to the betaN controller	(S. P. Gerhardt)	0.3 + 0.0(0.0)
	Test of ideal MHD stability as a function of A and elongation	(S. P. Gerhardt)	1.0(0.5)
	MHD stability at Low-A and high normalized current	(S. P. Gerhardt)	1.0(0.5)
	Opt. of early heat. and ramp rate to achieve stable op. at red. den.	(S. P. Gerhardt)	1.0(0.5)
3:45	Break		
4:00	Breakout session for prioritization		