

Update & Discussion on JRT-2015

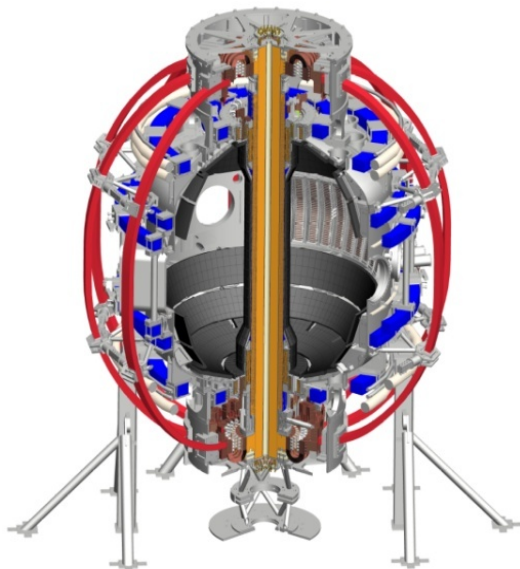
*Coll of Wm & Mary
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U Tulsa
U Washington
U Wisconsin
X Science LLC*

M. Podestà, S. Gerhardt

**PPPL, room B318
11/24/2013**

Reference material:

[http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/
Monday_Physics_Meetings/2014/2014_11_24/](http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Monday_Physics_Meetings/2014/2014_11_24/)



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York U
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ASCR, Czech Rep*

Outline

- Update on JRT-15: status, timeline
- Draft 1st Quarter Milestone report

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JRT-15 goal: “Assess impact of broadened current and pressure profiles on confinement and stability”

- Annual target:

*Conduct experiments and analysis to **quantify the impact of broadened current and pressure profiles on tokamak plasma confinement and stability**. Broadened pressure profiles generally improve global stability but can also affect transport and confinement, while broadened current profiles can have both beneficial and adverse impacts on confinement and stability. This research will examine a variety of heating and current drive techniques in order to **validate theoretical models of both the actuator performance and the transport and global stability response** to varied heating and current drive deposition.*

- Coordination:

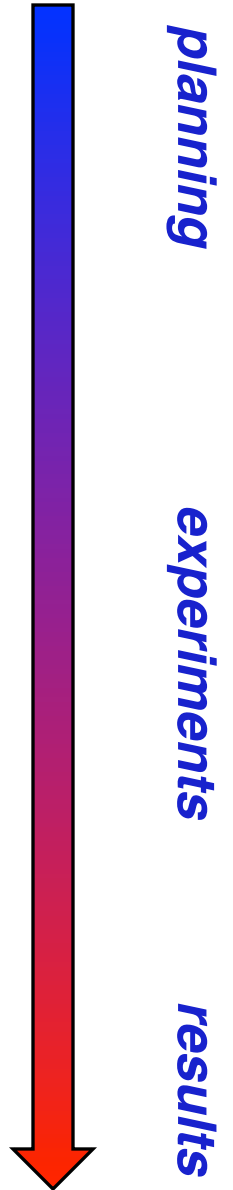
- M. Podestà, S. Gerhardt (NSTX-U)
- C. Holcomb, W. Solomon (DIII-D)
- G. Wallace, S. Scott (C-Mod)

Quarterly Milestones have been defined & approved by FES

- 1st Quarter
 - Analyze data to define new experiments
 - Develop an initial plan for collaborative experiments
- 2nd Quarter:
 - Finalize plan for experiments in FY-15
- 3rd Quarter:
 - Begin experiments on at least 2 facilities
 - Adjust plans for final Quarter (if necessary)
- 4th Quarter
 - Complete planned experiment & analysis
 - Prepare joint report
 - Identify important paths for future research

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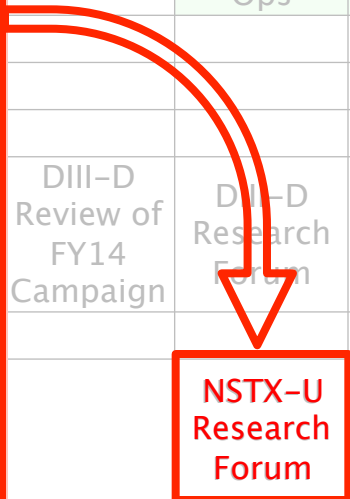
Timeline

2014			2015								
<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>
1 st quarter			2 nd quarter			3 rd quarter			4 th quarter		
		1st QM Report			2nd QM Report			3rd QM Report			4th QM Report
	DIII-D Ops							DIII-D Ops			
				C-Mod Ops	C-Mod Ops?						
							NSTX-U Ops				
			DIII-D Review of FY14 Campaign	DIII-D Research Forum		DIII-D PAC					
				NSTX-U Research Forum							NSTX-U PAC (tentative)

...all subject to change...

Timeline

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Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1 st quarter			2 nd quarter			3 rd quarter			4 th quarter		
		1 st QM Report			2 nd QM Report			3 rd QM Report			4 th QM Report
	DIII-D Ops							DIII-D Ops			
			C-Mod Ops	C-Mod Ops?							
							NSTX-U Ops				
			DIII-D Review of FY14 Campaign	DIII-D Research Forum		DIII-D PAC					
											NSTX-U PAC (tentative)



Feedback from NSTX-U Team needed for

- *Next Coordination Meeting with DIII-D, C-Mod (first week of December)*
- *1st Quarter Report (in preparation)*

Outline

- Update on JRT-15: status, timeline
- Draft 1st Quarter Milestone report

Goal of 1st Quarter: *based on analysis of previous data, develop initial plan for collaborative experiments*

- Two main areas for collaborative experiments identified
 - Performance vs NBI parameters (also part of R15-2 Milestone)
 - Current profile control
 - Effects of Energetic Particle (EP)-driven instabilities
 - Global stability (also part of R15-1, R15-3 Milestones)
 - Including disruptivity

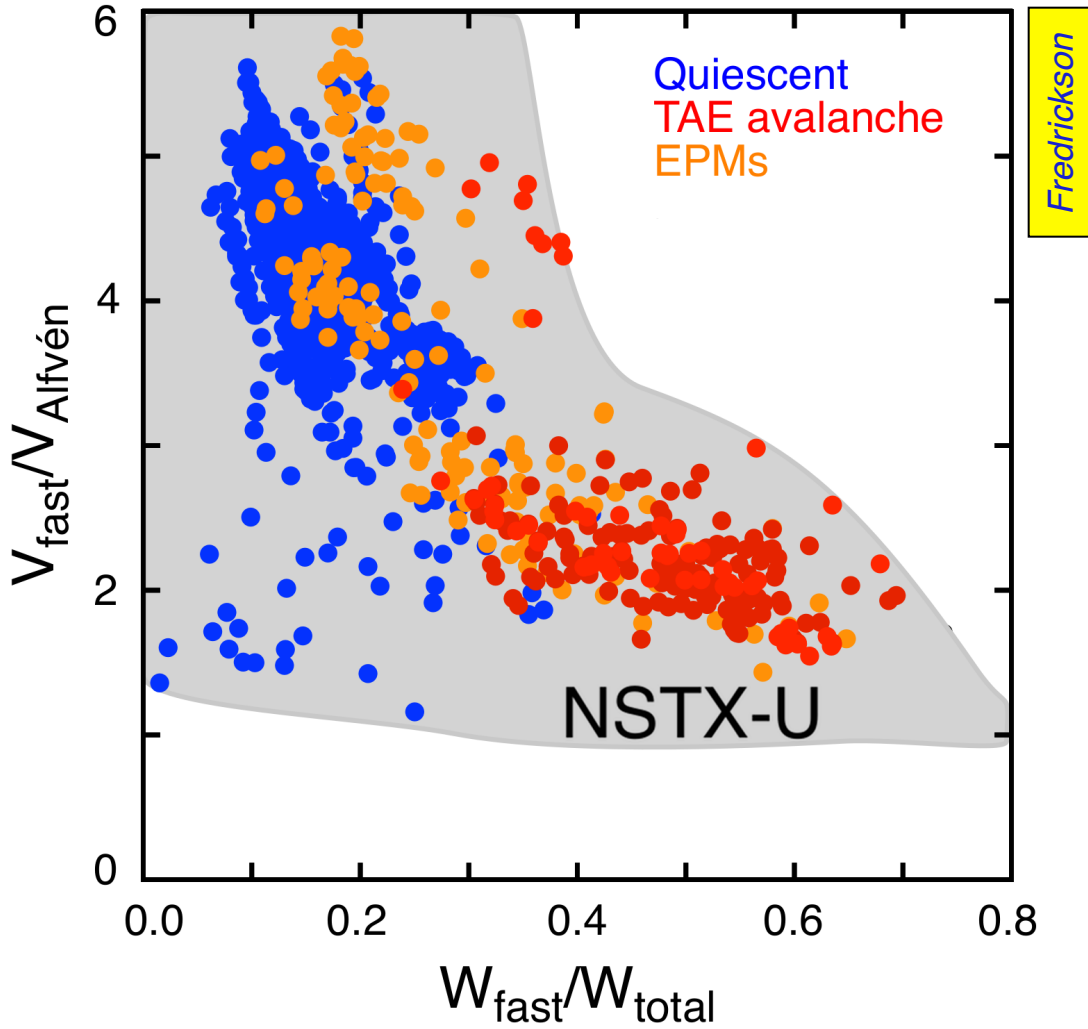
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 - Including disruptivity

topic	plan	facilities
Map AE/EPM stability	Extend database <i>à la</i> Fredrickson (I_p , B_t , $q(r)$, peaking, ...)	NSTX-U, DIII-D <i>C-Mod w/ ICRF?</i>
Improve EP modeling tools in integrated simulations	Validate, apply reduced models for improved simulations	NSTX-U, DIII-D
Current profile control	Assess $j(r)$ vs actuators (NBI, LHCD)	NSTX-U, DIII-D, C-Mod
Role of kinetic effects on global stability	Assess I/RWM stability vs $j(r)$, broadened pressure	NSTX-U, DIII-D
Rotation control	Develop control schemes using NBI, NTV as actuators	NSTX-U, DIII-D <i>C-Mod (intrinsic ω_ϕ)?</i>
Disruption PMA	Develop model-based disruption prediction algorithms	NSTX-U <i>DIII-D?</i>

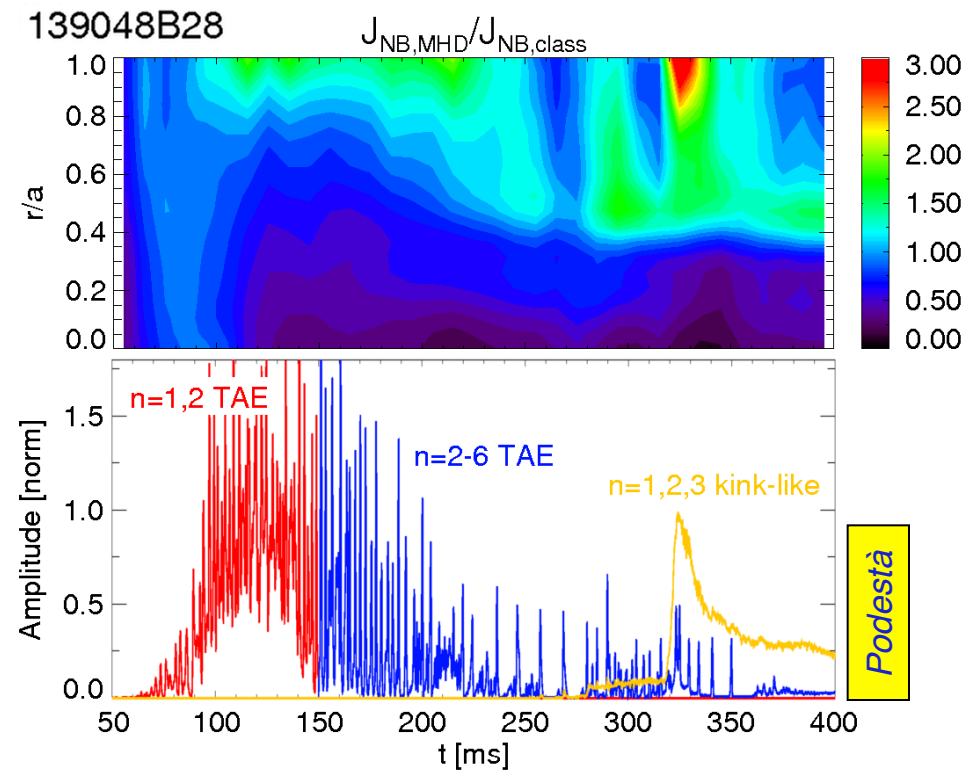
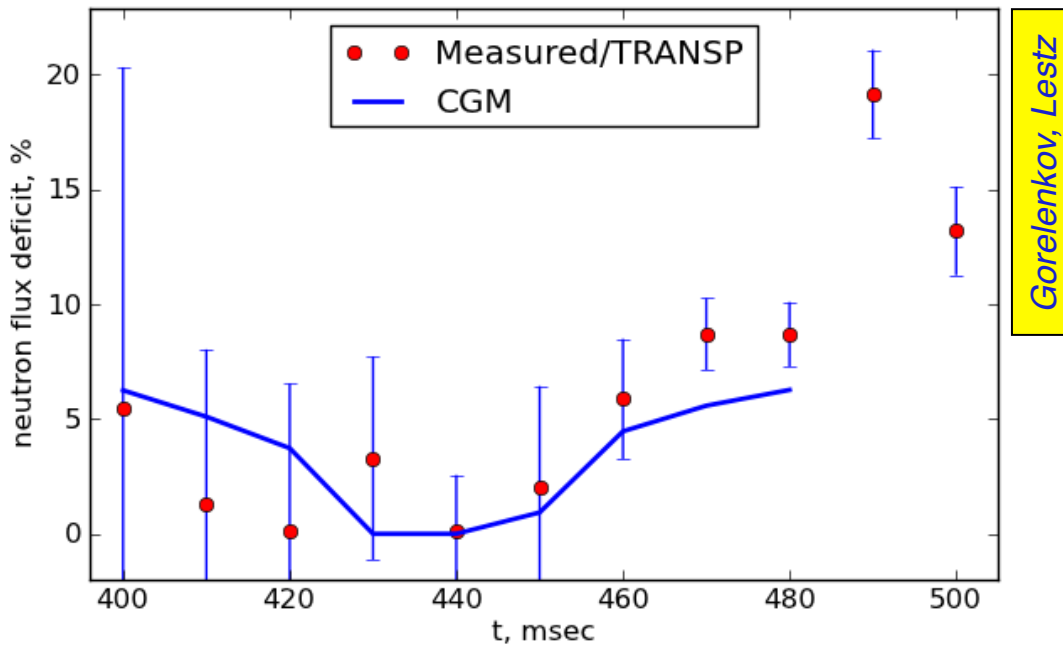
Database of stable vs. unstable EP-driven modes; analysis is progressing to include q-profile and pressure peaking factors

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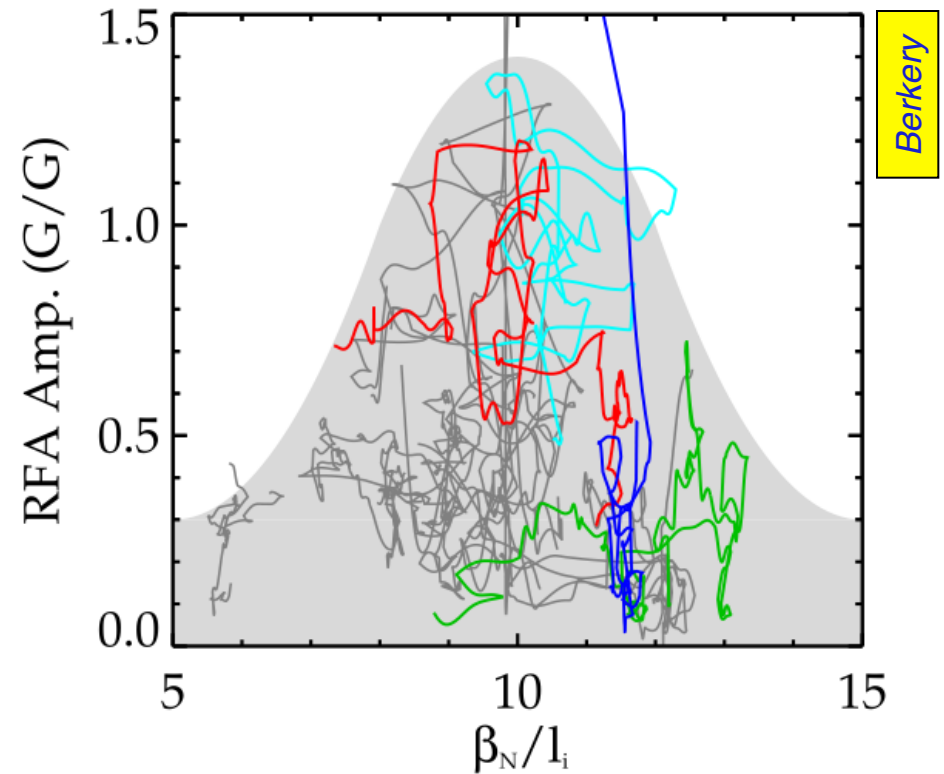
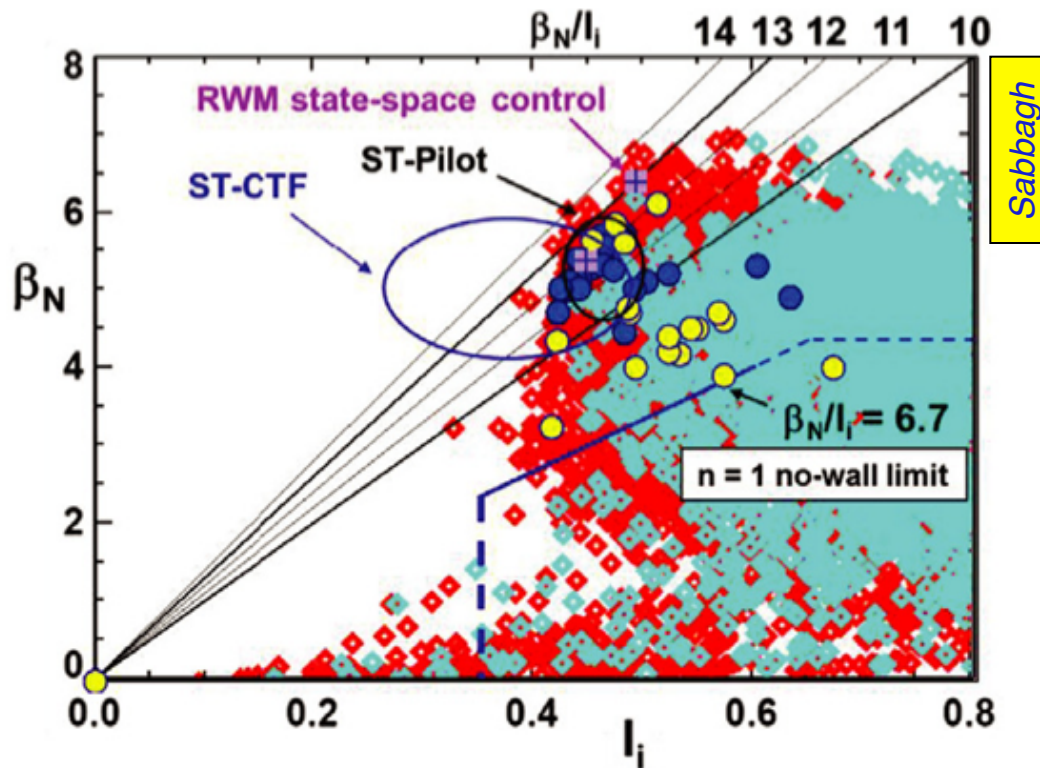
Improve existing modeling tools, develop new tools to assess EP effects on plasma performance

topic	plan	facilities
Improve EP modeling tools in integrated simulations	Validate, apply reduced models for improved simulations	NSTX-U, DIII-D



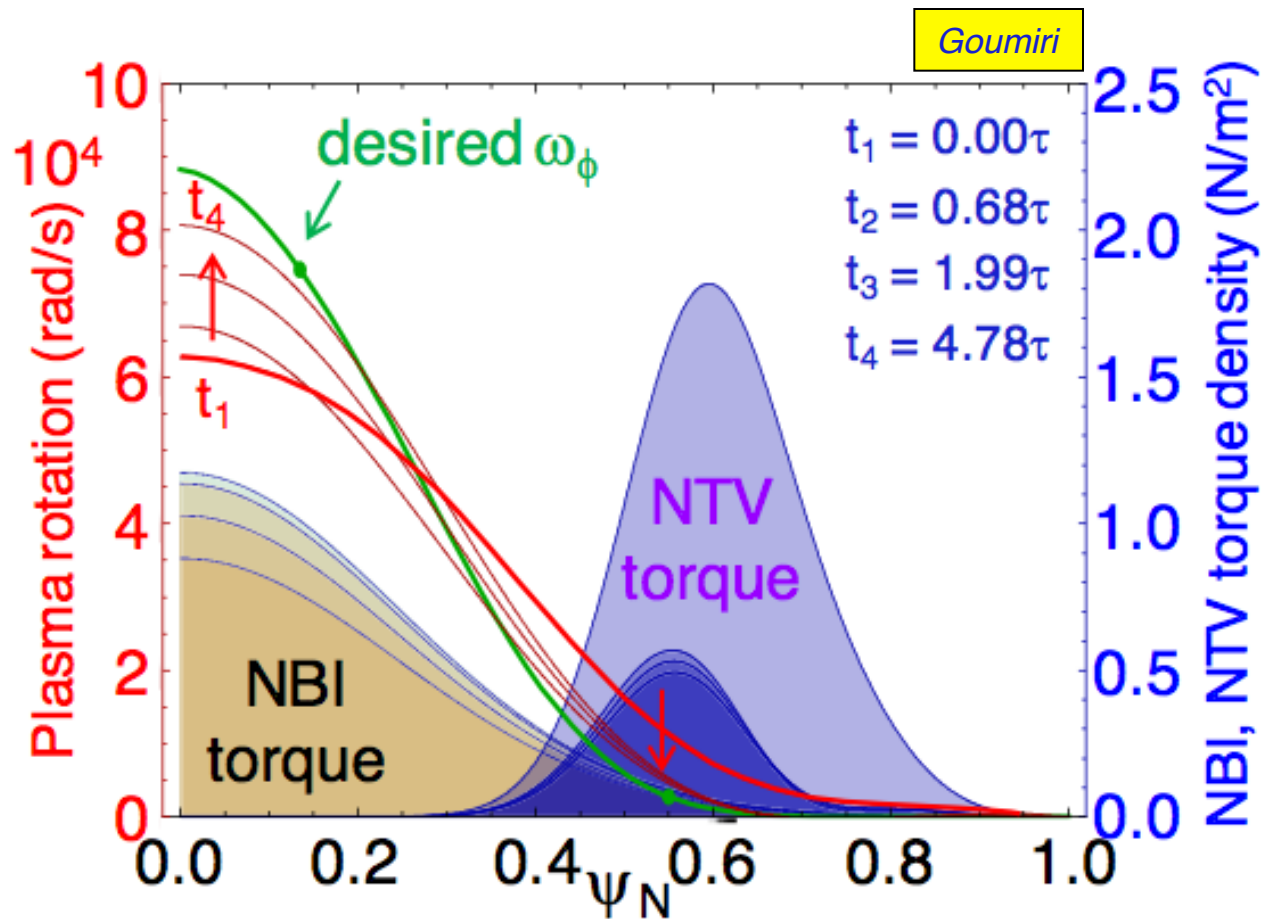
Experiments on NSTX-U will target discharge optimization to sustain stable scenarios at high beta, low I_i

topic	plan	facilities
Role of kinetic effects on global stability	Assess I/RWM stability vs $j(r)$, broadened pressure	NSTX-U, DIII-D



Control schemes using NBI, NTV as actuators in state-space rotation feedback controller are being designed for NSTX-U

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Open questions et al.

- *Additional [recent!] analysis & tools development to be considered:*
 - Profile modification effects on thermal transport (T&T TSG).
 - Use of lithium for ELM-free scenarios, pedestal modification (Pedestal TSG).
 - ***Others?***
- Should we include plans for *international collaborative work*?
 - E.g.: work on KSTAR on RWM stability
 - E.g.: DIII-D scenario development for high- q_{min} on KSTAR
- ***Please send me your comments on 1st Quarter report by 12/01***
 - http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Monday_Physics_Meetings/2014/2014_11_24/