NSTX-U

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EP-TSG: draft plans for commissioning & first research phases of NSTX-U operation

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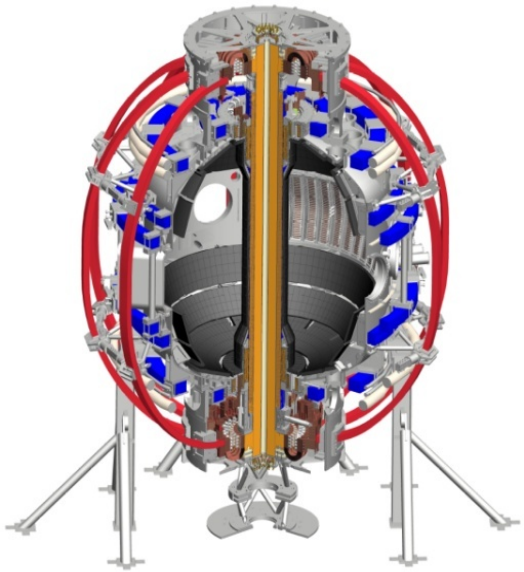
Pre-Forum Meeting #2
PPPL, Room B318
Jan. 28-29, 2015



EP-TSG goals for FY-15

Milestone R15-2:

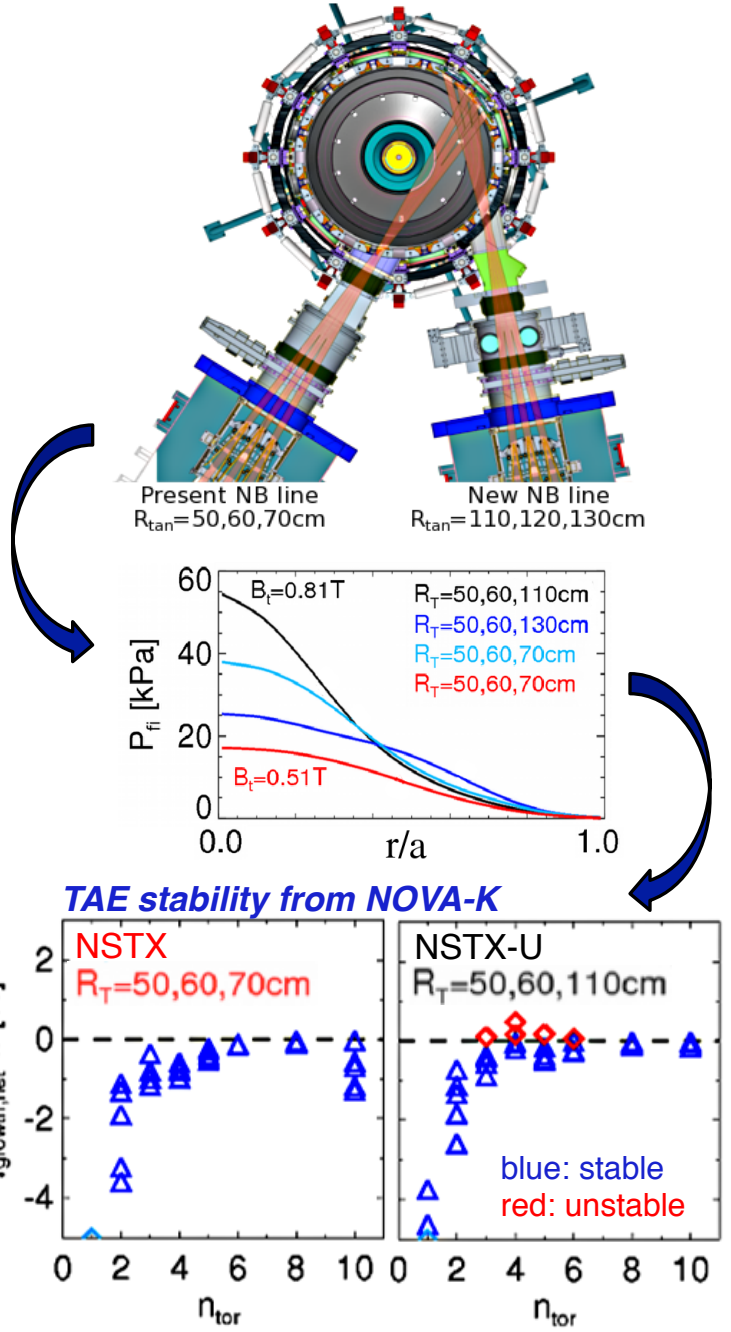
Assess effects of NBI parameters on fast ion distribution function, NB driven current profile.

FY15 FES Joint Research Milestone:

Quantify impact of broadened current and pressure profiles on confinement and stability.

Extend studies of EP transport by MHD to extended parameter range of NSTX-U

Experimental work supports validation of first-principle & reduced EP transport codes/ models.



Target for first ~8 weeks of EP research: re-commission primary diagnostics, establish baseline for JRT-15 & R15-2

- *Planned XMPs:*
  - Neutron calibration: low P_{NB} discharges, E_{inj}=40-50keV
    - Transfer calibration from pulse-counting to current mode
  - FIDA/ssNPA/sFLIP checkout
    - Commission new t-FIDA, ssNPA systems; checkout sFLIP & v-FIDA

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- *Proposed topics for initial XPs:*
  - NUBEAM "sanity check"
    - MHD-quiescent plasmas, low P_{NB} (NB blips)
    - Check NUBEAM modeling for "classical" conditions, NBI #1,2
  - On- vs. off-axis NB for "fiducial-like" H-mode
    - Move up in P_{NB}, use "standard" H-mode target
    - Perform initial assessment of J_{NB} vs NBI
  - Dependence of fast ion distribution on NBI parameters
    - Systematic scans of tangency radii, NBI energy
    - Assess resulting F_{NB}; initial characterization of *AEs vs. F_{NB}

Backup – Additional Info

Draft plans, ideas for EP research during initial ~8 weeks

		run week period		EP Run time [days]	Notes/requirements	Who
XMP list		1-4	5-8			
- FIDA/ssNPA/sFLIP checkout		x		1	Need sufficiently clean plasmas for FIDA (low Oxygen), NBI#1	UCI, Darrow
- Neutron counters calibration		x		0.5	Low power NB, Vinj=40-50kV, NBI#1	Darrow
Draft XP topics						
- NUBEAM "sanity check" in MHD quiescent plasmas R15-2		x (*)	x	1	All 6 NB sources operational, calibrated neutron detectors, profile diagnostics & TRANSP	UCI, EP-TSG
- On- vs. off-axis NBI for fiducial-like H-mode plasmas (JRT-15, part 1)			x	1 (*)	First take at JRT-15. Need all profile diagnostics, NB sources up & running, TRANSP, fast ion diagnostics	Podestà et al
	> Study dependence of Jnb on NBI parameters					
	> Dependence of fast ion distribution on NBI parameters R15-2					
		(*) pending availability of profile diags		(*) with ASC, MS, T&T		

Please provide additional input/ideas at FY-15 NSTX-U Research Forum

Proposed ideas for EP research after initial ~8 weeks

		run week period	EP Run time [days]	Notes/requirements	Who
		9-18			
- *AE stability at higher B-field, current		x	2	Need reliable operations up to B=0.75T, Ip=1.5MA	EP-TSG
	> Extend database of *AE stability parameter space				
	> Data for theory/experiment comparison				
	> Data to validate predictive approaches for EP transport				
- Investigate threshold for "linear" *AE regime		x	0.5		EP-TSG + Theory
- High frequency *AEs at high B-field		x	1 (**)		Fredrickson, Crocker
	> Data for high-f *AE codes validation				
	> Assess CAE/KAW channeling and impact on thermal electron transport				
- On- vs. off-axis NBI for fiducial-like H-mode plasmas (JRT-15, part 2)		x	2 (*)	Data for JRT-15	Podestà et al
- Effects of 3D fields on fast ion transport		x	1	piggyback?	
- TAE antenna XP		x	1	Requires antenna hardware development	Fredrickson
- Diagnosing fast ion transport with CFPA system		x	1	Ip and Bt scans	Boeglin
- Fast ion interaction with HHFW		x	1 (***)	Need HHFW, Prf>2MW	
- HHFW effects on rotation		x	0.5 (***)	Need HHFW, Prf>2MW	Podestà
- *AE suppression with HHFW		x	0.5 (***)	Need HHFW, Prf>>1MW	Fredrickson
			(*) with ASC, MS, T&T		
			(**) with T&T		
			(***) with RF		

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Requirements for NUBEAM "sanity check" XP

Objectives:

- ***Verify that experiments agree with TRANSP runs for well-controlled conditions, when "classical" fast ion physics is expected to be OK.***
- ***Compare basic metrics (neutron rate vs. NBI source, build-up/decay rates from NB-blip experiments)***

- Study behavior of "diluted" fast ion population, β_{fast}<<<1
- Low NB power (P<<4MW, varying NB mix) for no detectable MHD
- Need all 6 NB sources with modulation capability
- Need minimum diagnostics coverage to run TRANSP: profiles, calibrated neutrons, possibly sFLIP.
- Short, L-mode plasmas with 0.3-0.5sec flat-top are OK. Focus on NBI's: NSTX-like I_p, B_t are OK.
- Two/three-point B_t scan (0.4-0.6T) and I_p (0.7-1MA) desirable if sFLIP is available to compare measured/predicted prompt losses trend (reinforces sanity check).
- If FIDA, ssNPA are available and plasma conditions are OK (i.e., low impurity level) XP may be combined with "FIDA/ssNPA checkout" XMP.

Requirements for "on- vs. off-axis NBI for fiducial-like H-mode plasmas" XP (JRT-15, part 1)

Objectives:

> ***What are the different NB sources doing? Can we reliably model them for standard NSTX-U H-mode scenarios?***

> ***Compare NB-CD performance for fiducial-like H-mode plasma as a function of NBI mix; assess fast ion profile variations as a function of NBI mix.***

- Builds on XP#1 as reference for TRANSP consistency with Expt's
- Need good plasma performance (e.g. reproducible H-mode scenario, longer pulses with ~1sec flat-top)
- Need all 6 NB sources with injection voltage scan capabilities
- Good diagnostics coverage required: profiles, neutrons, MSE, FIDA, ssNPA,sFLIP.
- Requires I_p, B_t scans (I_p=0.6-1.2MA, B_t=0.4-0.65T)