



U.S. DEPARTMENT OF
ENERGY

Office of
Science



NSTX-U Program Update

Jon Menard

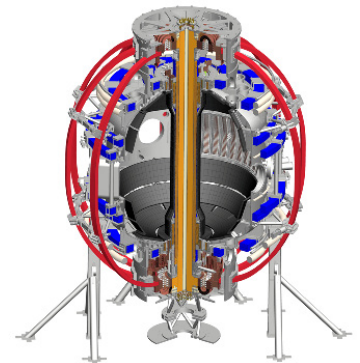
NSTX-U Program Director

NSTX-U Team Meeting

PPPL - MGB

August 14, 2015


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Outline




- Updated PPT template, logos, etc...
- Outreach Seminars
- Diagnostic Solicitation
- Updated Research Milestones
- XP Review Status, Draft Run Schedule
- International ST Workshop


This new PPTX template now available

 **National Spherical Torus eXperiment Upgrade**

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 **U.S. DEPARTMENT OF ENERGY** **Office of Science**   **NSTX-U**



Upcoming and Recent NSTX-U Meetings:

- [18th International Spherical Torus Workshop \(ISTW-2015\)](#)
Princeton University, 3-6 November 2015
- [Physics Operator Training Course](#)
- [Theory and Simulation of Disruptions](#)

Quick Links for Additional Information:

- [Presentation Template](#)
- [Run Schedule](#)
- [Experimental Proposals](#)
- [Monday Physics Meetings](#)

PPTX, PPT, PNGs, JPGs

NSTX-U icons / logos included in template

Usage compliance will be tracked in performance appraisals and RoDs - just kidding...

 **NSTX Upgrade**



 **NSTX Upgrade**

 **NSTX-U**  **NSTX-U**

 **National Spherical Torus
eXperiment Upgrade**

 **National Spherical Torus eXperiment Upgrade**

NSTX-U university collaborators spearheaded new outreach seminar effort – to begin this fall

National Spherical Torus eXperiment Upgrade

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Outreach Seminars

The following NSTX-U team members are available to give seminars at your institution on the topics / titles listed below, and may also be willing to speak on other related topics as well. If you are interested, please contact the speaker directly and CC Stan Kaye (kaye@pppl.gov), or click on an e-mail link below.

Name	e-mail	Research interest / specialty	Prospective Talk Title
Jack Berkery	jbarkery@pppl.gov	Fusion plasma stability	"Resistive wall mode stability in NSTX"
Walter Guttenfelder	wgutten@pppl.gov	Turbulence in magnetized fusion plasmas	"Understanding turbulence at 100 million degrees"
Ahmed Diallo	adiallo@pppl.gov	H-mode pedestal, diagnostics	"Taming the plasma edge for optimum fusion performance"
Devon Battaglia	dbattagl@pppl.gov	Tokamak startup, H-mode physics, high-performance computing	"Physics operations and scenario development on NSTX-U"
Jon Menard	jmenard@pppl.gov	Research program, next-step devices, MHD physics	"NSTX-U program overview" <i>or</i> "Prospects for next-step STs"
David Smith	drsmith@pppl.gov	Plasma turbulence and instabilities, turbulence diagnostics	"Characterizing edge instabilities with machine learning techniques"
Clayton Myers	cmyers@pppl.gov	Tokamak disruptions and error fields, laboratory astrophysics	"Two Challenges for Steady State Tokamak Operation: Error Fields and Disruptions" <i>or</i> "Bringing the Cosmos Down to Earth: Studying Astrophysical Processes in Laboratory Experiments"
Rory Perkins	rperkins@pppl.gov	Radio frequency heating	"Fast wave power flow along scrape-off-layer field lines in NSTX"
Steven Sabbagh	sabbagh@pppl.gov	Tokamak plasma stability and control for disruption prediction and avoidance	"Global Mode Stabilization for Disruption Avoidance in Tokamaks"

J. Berkery (CU)
D. Smith (UW)

FES solicitation for U.S. University and Industry DIAGNOSTIC Collaboration on NSTX-U now available

- Pre-Application was due: 07/29/2015
 - Pre-App required, 2-3 pages (Title, abstract, collaborators, ...)
 - Nearly all (15-20) pre-apps accepted
- **Application Due: 09/18/2015, 11:59 PM Eastern**
 - Signed Records of Discussion (RoDs) required for application
- RoDs due to Jon and Masa for review by 9/10/2015
- If you are a research contact – get RoDs discussed, reviewed / iterated, and signed ASAP
 - Be proactive, work closely with collaborators on their RoDs, and don't wait until the last minute...
 - Note: Jon will be on travel most of week of September 14

Overview of FY2015-17 NSTX-U research milestones

- **FY2016**

- Obtain first data at 60% higher field/current, 2-3× longer pulse:
 - Re-establish sustained low I_i / high- κ operation above no-wall limit
 - Study thermal confinement, pedestal structure, SOL widths
 - Assess current-drive, fast-ion instabilities from new 2nd NBI

- **FY2017**

- Extend NSTX-U performance to full field, current (1T, 2MA)
 - Assess divertor heat flux mitigation, confinement at full parameters
- Access full non-inductive, test small current over-drive
- First data with 2D high-k scattering, prototype high-Z tiles

- **FY2018**

- Study low-Z and high-Z impurity transport
- Assess causes of core electron thermal transport
- Test advanced q profile and rotation profile control
- Assess CHI plasma current start-up performance

NSTX-U Milestone Schedule for FY2016-18

(see updated Milestone web-page for additional detail / text)

	FY2016	FY2017	FY2018
Run Weeks:	Incremental 14 16	16 18	12 16
Boundary Science + Particle Control	R16-1 Assess H-mode confinement, pedestal, SOL characteristics at higher B_T , I_P , P_{NBI}	R17-1 Assess scaling, mitigation of steady-state, transient heat-fluxes w/ advanced divertor operation at high power density R17-2 Assess high-Z divertor PFC performance and impact on operating scenarios	R18-1 Assess impurity sources and edge and core impurity transport IR18-1 Investigation of power and momentum balance for high density and impurity fraction divertor operation
Core Science	R16-2 Assess effects of NBI injection on fast-ion $f(v)$ and NBI-CD profile	R17-3 Assess τ_E and local transport and turbulence at low v^* with full confinement and diagnostic capabilities	IR18-2 Assess role of fast-ion driven instabilities versus micro-turbulence in plasma thermal energy transport Begin ~1 year outage for major facility enhancement(s) sometime during FY2018
Integrated Scenarios	R16-3 Develop physics + operational tools for high-performance: κ , δ , β , EF/RWM	IR17-1 Assess fast-wave SOL losses, core thermal and fast ion interactions at increased field and current R17-4 Develop high-non-inductive fraction NBI H-modes for sustainment and ramp-up	R18-2 Control of current and rotation profiles to improve global stability limits and extend high performance operation R18-3 Assess transient CHI current start-up potential in NSTX-U
FES 3 Facility Joint Research Target (JRT)	C-Mod leads JRT Assess disruption mitigation, initial tests of real-time warning, prediction	DIII-D leads JRT TBD... possibly something on energetic particles	NSTX-U leads JRT TBD

Chosen first 30 experiments to review: Order based on Priority 1 + expected period to be run during campaign

At least 30 XPs will be fully reviewed prior to start of research campaign

►17 XPs already reviewed, remaining reviews will be scheduled very soon...

XP number	XP title	Responsible Group	XP author first name	XP author last name	XP author e-mail	Priority	Run Weeks 1-4	Run Weeks 5-8	Run Weeks 9-12	Run Weeks 13-16
1501	Optimization of vertical control algorithm	ASC-TSG	Dan	Boyer	mboyer@pppl.gov	P1a	1			
1502	Tuning of the Automated Rampdown Software	ASC-TSG	Stefan	Gerhardt	sgerhard@pppl.gov	P1c	1			
1503	X-point control integration with shape control	ASC-TSG	Egemen	Kolemen	ekolemen@princeton.edu	P1a	1			
1504	Beam power and beta-N control	ASC-TSG	Dan	Boyer	mboyer@pppl.gov	P1b	0.5	0.5		
1505	Optimizing Boronization XMP	MP-TSG	Charles	Skinner	cskinner@pppl.gov	P1a	0.5	0.5		
1506	Low-beta, low-density locked mode studies	MS-TSG	Clayton	Myers	cmymers@pppl.gov	P1a	0.25	0.75		
1507	Maximizing the non-inductive current fraction in NSTX-U H-modes	ASC-TSG	Stefan	Gerhardt	sgerhard@pppl.gov	P1a		0.5	0.25	0.25
1508	Controlled Snowflake Studies	ASC-TSG	Egemen	Kolemen	ekolemen@pppl.gov	P1b		0.25	0.5	0.25
1509	Combined betaN and li feedback control	ASC-TSG	Dan	Boyer	mboyer@pppl.gov	P1b		0.25	0.25	0.5
1510	Characterizing the SOL Losses of HHFW Power in H-Mode Plasmas	RF-TSG	Rory	Perkins	rperkins@pppl.gov	P1a		0.5	0.25	0.25
1511	Multi-machine studies of the L-H power threshold dependence on aspect ratio	PS-TSG	Michael	Bongard	mbongard@wisc.edu	P1b		1		
1512	Characterization of the Pedestal Structure as function Ip, BT, and Pnbi	PS-TSG	Ahmed	Diallo	adiallo@pppl.gov	P1a		0.5	0.5	
1513	Effects of B-> Li transition on the pedestal structure	PS-TSG	Rajesh	Maingi	rmaingi@pppl.gov	P1a		0.5	0.5	
1514	Heat flux and SOL width Scaling in NSTX-U	DS-TSG	Travis	Gray	tkgray@pppl.gov	P1a		0.25	0.5	0.25
1515	High-beta n=1,2,3 feed-forward error field correction	MS-TSG	Clayton	Myers	cmymers@pppl.gov	P1a		0.5	0.5	
1516	Optimization of PID dynamic error field correction	MS-TSG	Clayton	Myers	cmymers@pppl.gov	P1a		0.5	0.5	
1517	Neoclassical toroidal viscosity at reduced collisionality (independent coil control)	MS-TSG	S.A.	Sabbagh	sabbagh@pppl.gov	P1a		0.25	0.5	0.25
1518	RWM PID control optimization based on theory and experiment	MS-TSG	S.A.	Sabbagh	sabbagh@pppl.gov	P1a		0.25	0.5	0.25
1519	Massive Gas Injection Studies on NSTX-U	MS-TSG	Roger	Raman	raman@aa.washington.edu	P1a			0.5	0.5
1520	Ip/Bt scaling	TT-TSG	Stan	Kaye	kaye@pppl.gov	P1a		0.5	0.25	0.25
1521	Validation of gyrokinetic codes in NSTX-U NBI-heated L-mode plasmas	TT-TSG	Yang	Ren	yren@pppl.gov	P1a		0.5	0.25	0.25
1522	Beam ion confinement of 2nd NBI	EP-TSG	Deyong	Liu	deyongli@uci.edu	P1a		0.75	0.25	
1523	Characterization of 2nd NBI line	EP-TSG	Mario	Podesta	mpodesta@pppl.gov	P1a		0.25	0.5	0.25
1524	AE Critical Gradient	EP-TSG	Bill	Heidbrink	wwheidbr@uci.edu	P1a		0	0.25	0.75
1525	Rotation effects on CAEs and GAEs	EP-TSG	Neal	Crocker	ncrocker@physics.ucla.edu	P1a				1
1526	Establish heat transmission pathways in high-Z reference shape	MP-TSG	Michael	Jaworski	mjaworski@pppl.gov	P1a		0.25	0.25	0.5
1527	ELM pacing via multi-species granule injection and 3D field application for main ion c	PC-TF	Robert	Lunsford	rlunsfor@pppl.gov	P1a		0.75	0.25	
1528	Characterize plasma near planned plenum entrance position	PC-TF	John	Canik	canikjm@ornl.gov	P1a		0.75	0.25	
1529	Controlled introduction of Lithium into NSTX-U	PC-TF	Rajesh	Maingi	rmaingi@pppl.gov	P1a		0.5	0.5	
1530	Triggering ELMs with LGI and 3-D fields in lithiated discharges	PC-TF	Robert	Lunsford	rlunsfor@pppl.gov	P1a			0.75	0.25

Latest run plan schedule for 2016


Goal is to operate 14-16 run weeks as per research forum

- If FY16 budgets are favorable enough, may run more run weeks
- Want as much data as possible for IAEA synopses/meeting, APS-2016

- October: 0-2 run weeks (XMP)
 - Depends on bake-out / ISTP / NBI / diagnostic time required...
- November: 0-2 run weeks (XMP → XP)
 - May want to slow/pause for ST workshop, APS, Thanksgiving
- December: 3 run weeks (XP)
- January: 2-3 run weeks (XP)
 - Mid-run assessment (if applicable), PAC-37
- Feb-Apr: 6-8 run weeks, complete FY16 run
- Apr/May: Start outage: install high-k, high-Z tiles, ...
- Resume operations fall/winter 2016 for FY17

ST workshop abstracts due TODAY!

~40+ (many international) abstracts already submitted







ISTW-2015

ISTW 2015 Web Pages:

- Home
- Abstract Submission**
- Accommodations / Hotel
- Agenda and Presentations
- Conference Venue
- Important Dates
- Local Organizing Committee
- Meeting Format
- Objectives and Topics
- Program Committee
- Reception and Banquet
- Registration and Payment Forms
- Travel to Princeton
- Visa Information
- Sitemap

Other Useful Links:



Abstract Submission

- **Abstracts are due August 14, 2015**
- All submitted abstracts should be submitted in PDF format.
 - Please use this [MS Word Abstract Template](#) and convert it to or save it as PDF.
- If you do not use the template, please prepare your abstract as follows:
 - Length: [One page](#)
 - Page size: [US Letter size \(279mm by 216 mm\) vertical orientation](#)
 - Margins: [1 inch \(25mm\) all around](#)
 - Title: [Single-spaced, 14-point size, Times New Roman Font, bold](#)
 - Authors: [Single-spaced, 12-point size, Times New Roman Font](#)
 - Affiliation: [Single-spaced, 12-point size, Times New Roman Font, italic](#)
 - Text: [1.5 spaced, 12-point size, Times New Roman Font](#)
- **Please use the form below to upload your PDF abstract**
 - Name your PDF file using this convention: `lastname_abbreviated-title.pdf`

ISTW 2015 Abstract Uploader Form

Author first name *

• Here's the link: istw-2015.pppl.gov/abstract-submission

ST workshop important dates

- Invitation Letter for Application of Visa: **ASAP**
- Reduced rate hotel reservations (Nassau Inn) available: **NOW**
- Submission of Abstracts: **August 14, 2015**
- Announcement of acceptance of Papers: **August 28, 2015**
- Registration Opens: (no later than) **September 14, 2015**
 - Registration fee: \$65
 - Catered/wine reception at Princeton Art Museum: \$35
 - Banquet at Prospect House: \$65
- Hotel at reduced rate ENDS: **Friday, October 2, 2015**
- Meeting: **November 3-6, 2015** in McDonnell Hall, Princeton U.



Thank you for:

- Making 1st test-plasma / CD-4 happen!
 - Staff / lab-wide celebration being planned – stay tuned
- Serving as a collaboration RoD research contact
 - And getting RoDs completed, reviewed, signed ASAP
- Volunteering to be an NSTX-U seminar speaker
- Revising reviewed XPs (so we can approve them)
 - And getting unreviewed XPs reviewed and approved
- Participating in ST workshop → new collaborations
 - Get those abstracts in TODAY!

