NSTX-U

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NSTX-U Program Update

J. Menard

For the NSTX-U Research Team

NSTX-U Team Meeting
MBG Auditorium
May 1, 2015

Coll of Wm & Mary
Columbia U
CompX
General Atomics
FIU
INL
Johns Hopkins U
LANL
LLNL
Lodestar
MIT
Lehigh U
Nova Photonics
Old Dominion
ORNL
PPPL
Princeton U
Purdue U
SNL
Think Tank, Inc.
UC Davis
UC Irvine
UCLA
UCSD
U Colorado
U Illinois
U Maryland
U Rochester
U Tennessee
U Tulsa
U Washington
U Wisconsin
X Science LLC

Culham Sci Ctr
York U
Chubu U
Fukui U
Hiroshima U
Hyogo U
Kyoto U
Kyushu U
Kyushu Tokai U
NIFS
Niigata U
U Tokyo
JAEA
Inst for Nucl Res, Kiev
Ioffe Inst
TRINITI
Chonbuk Natl U
NFRI
KAIST
POSTECH
Seoul Natl U
ASIPP
CIEMAT
FOM Inst DIFFER
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
ASCR, Czech Rep

Outline

- Budget Planning Meeting, Milestones
- FES Community Workshops
- Research Forum Summary
- XP Preparation

Administration FY2016 request-level provides run-time and full field + current to exploit most new Upgrade capabilities

	FY2015	FY2016	FY2017
Run Weeks:	**12 → 8-10**	**14**	**14**
Boundary Science + Particle Control	R15-1 Assess H-mode confinement, pedestal, SOL characteristics at higher B_T, I_P, P_{NBI}	R16-1 Assess scaling, mitigation of steady-state, transient heat-fluxes w/ advanced divertor operation at high power density R16-2 Assess high-Z divertor PFC performance and impact on operating scenarios	R17-1 Assess impurity sources and edge and core impurity transport
Core Science	R15-2 Assess effects of NBI injection on fast-ion f(v) and NBI-CD profile		R17-2 Assess role of fast-ion driven instabilities versus micro-turbulence in plasma thermal energy transport
Integrated Scenarios	R15-3 Develop physics + operational tools for high-performance: κ, δ, β, EF/RWM	R16-3 Assess fast-wave SOL losses, core thermal and fast ion interactions at increased field and current R16-4 Develop high-non-inductive fraction NBI H-modes for sustainment and ramp-up	R17-3 Control of current and rotation profiles to improve global stability limits and extend high performance operation R17-4 Assess transient CHI current start-up potential in NSTX-U
FES 3 Facility Joint Research Target (JRT)	**NSTX-U leads JRT** Quantify impact of broadened J(r) and p(r) on tokamak confinement, stability	**C-Mod leads JRT** Assess disruption mitigation, initial tests of real-time warning, prediction	**DIII-D leads JRT** TBD

Incremental accelerates transport and divertor research, strongly utilizes facility, supports 5YP enhancements

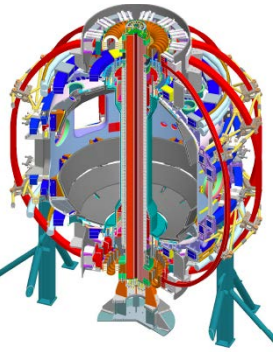
	FY2015	FY2016	FY2017
Run Weeks:	12 → 8-10	14 **16**	14 **16**
Boundary Science + Particle Control	R15-1: Assess H-mode confinement, pedestal, SOL characteristics at higher B_T, I_P, P_{NBI}	R16-1: Assess scaling, mitigation of steady-state, transient heat-fluxes w/ advanced divertor operation at high power density R16-2: Assess high-Z divertor PFC performance and impact on operating scenarios	R17-1: Assess impurity sources and edge and core impurity transport IR17-1: Investigation of power and momentum balance for high density and impurity fraction divertor operation
Core Science	R15-2: Assess effects of NBI injection on fast-ion f(v) and NBI-CD profile	IR16-1: Assess confinement and local transport and turbulence at low ν^* with full confinement and diagnostic capabilities	R17-2: Assess role of fast-ion driven instabilities versus micro-turbulence in plasma thermal energy transport
Integrated Scenarios	R15-3: Develop physics + operational tools for high-performance: κ, δ, β, EF/RWM	R16-3: Assess fast-wave SOL losses, core thermal and fast ion interactions at increased field and current R16-4: Develop high-non-inductive fraction NBI H-modes for sustainment and ramp-up	R17-3: Control of current and rotation profiles to improve global stability limits and extend high performance operation R17-4: Assess transient CHI current start-up potential in NSTX-U
FES 3 Facility Joint Research Target (JRT)	NSTX-U leads JRT: Quantify impact of broadened J(r) and p(r) on tokamak confinement, stability	C-Mod leads JRT: Assess disruption mitigation, initial tests of real-time warning, prediction	DIII-D leads JRT: TBD

Five Year Facility Enhancement Plan (green – ongoing)

2015: Performing engineering design for Cryo-Pump, NCC, ECH

2014	2015	2016	2017	2018
Upgrade Outage	1.5 → 2 MA, 1s → 5s			
Run Weeks:	8-10	6-8	8-10	14	12

New center-stack



2nd NBI

Boundary Science + Particle Control

- Pulse-burst MPTS
- Boronization
- Li granule injector
- MAPP
- Upward LiTER
- High-Z tile row on lower OBD
- Lower divertor cryo-pump
- High-Z PFC diagnostics
- LLD using bakeable cryo-baffle

Core Science

- MGI disruption mitigation
- Upgraded halo sensors
- Laser blow-off
- 42 ch MPTS
- 48 ch BES
- MSE/LIF
- High k_θ
- Charged fusion product
- 4 coil AE antenna
- δB diag. - incremental
- Off-midplane 3D coils (NCC) →
- Enhanced MHD sensors
- DBS, PCI, or other intermediate-k
- Neutron collimator

Integrated Scenarios

Establish control of:

- Snowflake
- FIReTIP
- Rotation
- $\bar{n}_e$
- q_{min}
- Divertor P_{rad}
- HHFW limiter upgrade
- 1 MW ECH/EBW →
- Upgraded CHI for ~0.5MA
- 0.5-1 MA CHI
- up to 1 MA plasma gun

- **Major upgrade – base funding**
- **Requires 15% incremental**

Outline

- Budget Planning Meeting, Milestones
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Substantial PPPL, NSTX-U Team, Collaborator input to FES Workshops – Leadership Roles:

- Transients:
  - Co-chair: R. Nazikian
  - Disruptions: D. Brennan (co-lead), S. Sabbagh, D. Gates
  - ELMs: R. Nazikian (lead), J. Canik (co-lead), O. Schmitz, W. Solomon
- PMI:
  - Chair: R. Maingi
  - SOL / Div: R. Goldston, J. Myra, V. Soukhanovskii
  - PMI / Div. Simulators: J.P. Allain (leader), M. Jaworski, B. Wirth
  - Engineering Innovation: C. Kessel (leader), R. Ellis, R. Majeski
  - Core-edge integ: J. Canik, M. Kotschenreuther, R. Majeski, R. Wilson
  - Cross-cutting: R. Maingi, J. Menard, H. Neilson
- Integrated Modelling
  - Disruptions: D. Brennan (co-lead), S. Gerhardt, S. Jardin
  - Boundary: J. Canik, C-S Chang, G. Hammett
  - WDM: C. Kessel (co-lead), B. Grierson, S. Kaye, F. Poli
  - Multi-hysics, multi-scale: G. Fu, G. Hammett
  - Data Management / Software Integration: S. Kaye / F. Poli

Substantial NSTX-U Team, PPPL, Collaborator input to FES Workshops - Transients

- 36% of 67 WPs: 13 for disruptions, 11 for ELMs

Topic	#	Name	Title
Disruptions	1	Kolemen	Real-Time Parallel DCON for Feedback Control of ITER Profile Evolution
	2	Glasser	Resistive DCON and Beyond
	3	Jardin	Proposed New Initiative in Disruption Modeling
	4	Stutman	Development of X-ray sensors and optical light extractors for Burning Plasma operation and co
	5	Raman	Development of a Fast Time Response Electromagnetic DM System
	6	Zakharov	VDE disruptions: theory, experiment, simulation steps beyond the Tokamak MHD (TMHD) mode
	7	Poli	The role of integrated modeling in disruption avoidance and profile control development
	8	Gerhardt	Improving Understanding of 3D Disruption Halo Currents
	9	Sabbagh	A National Initiative for Disruption Elimination in Tokamaks
	10	Raman	Need for Momentum Injection in ITER and Reactor Grade Plasmas
	11	Wang	The drift kinetic and rotational effects on determining and predicting the macroscopic magnetoh
	12	Schuster	Role of Model-based Control in Disruption-free Tokamak Operation
	13	Berkery	Disruptivity Reduction Research on NSTX-U, Including Characterization of Causes and Use of
ELMs	14	Mansfield	Li6 Aerosol Injection white paper
	15	Lunsford	Impurity ELM pacing via non-lithium granule injection
	16	Mansfield	The Use of Supersonic Molecular Beam Injection and Cluster Jet Injection to Induce
	17	Bongard	Multi-Scale Validation of Nonlinear ELM Physics
	18	Fonck	A Dedicated Laboratory for Nonlinear H-mode Pedestal and ELM Dynamics
	19	Bortolon	Development of ELM pacing by injection of light impurity granules
	20	Park	Filling the Gaps in Physics Understanding of Resonant Magnetic Perturbation (RMP) with NSTX
	21	Maingi	The need for research on a broad range of ELM control techniques
	22	Maingi	Extending High Confinement Scenarios Toward Steady State
	23	Chang	Gyrokinetic simulation of RMP penetration, plasma transport response, and edge localized mod
	24	Kolemen	Adaptive ELM Control Development for ITER

Substantial NSTX-U Team, PPPL, Collaborator input to FES Workshops – Boundary and PMI

- 29% of 56 Whitepapers: Evenly split among topical areas

Topic	#	Speaker	Title
SOL / Div	1	J.M. Canik	Model validation needs in boundary physics
	2	C.S. Chang	Importance of SOL plasma kinetic information for more reliable PMI data
	3	J.R. Myra	Understanding the SOL: Fundamental Physics Challenges
	4	V. Soukhanovskii	Snowflake divertor
	5	V. Soukhanovskii	Control of radiative divertor and detachment
PMI, Divertor Simulators	6	P. Krstic	Integrated, Multi-Scale Plasma-Material Interface Simulation
	7	R. Majeski	Test stands for liquid metal PFC development
	8	C.H. Skinner	Coordinated experimental-modeling approach to low-risk PFCs for FNSF/DEMO
	9	B.D. Wirth	Status of Modeling Plasma - Materials Interactions: Unresolved Issues & Future Op
Engineering Innovation	10	R.J. Goldston	An Example Opportunity for DIvertor Innovation: The Lithium Vapor-Box Divertor
	11	B.E. Koel	Liquid Metals As Plasma-Facing Materials For Fusion Energy Systems
	12	L.E. Zakharov	Flowing Liquid Lithium (24/7FLiLi): the technology step to burning plasma regimes
	13	R. Majeski	Lithium walls for fusion
Core-edge integration	14	C.S. Chang	Importance of kinetic physics in core-edge integration
	15	R. Majeski	Low recycling walls and confinement
	16	J.E. Menard	Potential challenges, research needs, and solutions for core-edge integration

Substantial NSTX-U Team, PPPL, Collaborator input to FES Workshops – Integrated Modelling

- 24% of 119 WP – Mostly Disruption PAM, Whole Dev. Modelling

Topic	#	Speaker	Title
Disruption PAM	1	Berkery	Disruptivity Reduction Research on NSTX-U, Including Characterization of Causes and Use of Kinetic Stability Theory
	2	Brennan	Toward Understanding Runaway Electron Generation in Disruptions
	3	Brennan	Looking Forward in Disruption Avoidance via Stability Analyses and Control
	4	Glasser	Resistive DCON and Beyond
	5	Jardin	Proposed New Initiative in Disruption Modeling
	6	Kolemen	Real-Time Parallel DCON for Feedback Control of ITER Profile Evolution
	7	Wang	The Drift Kinetic and Rotational Effects on Determining and Predicting the Macroscopic Magnetohydrodynamic Instability
	8	Zakharov	Thin Wall Model for Disruption Simulations in the Presence of Sources and Sinks
	9	Zakharov	Tokamak MHD (TMHD) Model of VDE Disruptions: Theory/Simulation Aspects
Boundary Physics and PMI	10	Hakim	Progress and Challenges in Plasma Boundary Simulations: Opportunities for Improved Algorithms
	11	Myra	Understanding the SOL: Fundamental Physics Challenges
	12	Stotler	Integrated, Multi-Scale Plasma-Material Interface Simulation
	13	Zakharov	Fusion (?) Energy (??) Science (???) and its Gaps and Integration
WDM	14	Bertelli	A Mode of Interoperability with the ITER IMAS
	15	Bertelli	The Role of RF Source Components in a Whole Device Model
	16	Bertelli	Integrating RF Power into Scrape-off-Layer Plasma Simulation
	17	Fu	Integrated Simulations of Energetic Particle Transport in Burning Plasmas
	18	Guttenfelder	First-Principles Simulations and Reduced Models for Core Turbulent Transport
	19	Hager	First-Principles Whole Device Modeling of Fusion Plasma on Extreme Scale Computers, in collaboration with ASCR scientis
	20	Hammett	Overall Motivation for Fusion Integrated Simulations: Developing Improved Fusion Power Plants
	21	Hammett	A Modular Approach to First-Principles Whole-Device Integrated Simulations
	22	Hawryluk	Role and Requirements for Whole Device Modeling
	23	Poli	The Role of Integrated Modeling in Disruption Avoidance and Profile Control Devlopment
	24	Reiman	Development of a Time-Dependent Transport Code that Can Handle Nonaxisymmetric Magnetic Fields with Islands and Sto
Multiphysics, Multiscale	25	Lee	A Multiphysics and Multiscale Coupling of Microturbulence with MHD Equilibria
Data management	26	Churchill	Scientific Knowledge Discovery in Data-Intensive, Large-Scale Fusion Simulations
	27	Mikkelsen	Thoughts on Data Management Tools for Physics Simulation Codes
	28	Poli	On the Visualization of Simulations
Software integration	29	Poli	On the Separation between Physics-Oriented Research and ITER-Driven Research and the Role of Software Performance

Outline

- Budget Planning Meeting, Milestones
- FES Community Workshops
- Research Forum Summary
- XP Preparation

Successful Research Forum held Feb 24-27, 2015

TSGs/ TFs developed prioritized plan consistent with guidance

50-55 run days available for physics / XPs

Baseline (12+4 weeks) # run weeks:	16	
Estimated total # run days:	80	
Estimated XMP run-days	25	Cross-cutting commissioning, shot development, calibrations (may not include TSG-specific XMPs)
Reserve for multi-TSG XPs	10	
Contingency / director's reserve	5	
Nominal total days for TSG/TFs to prioritize	50	
Minimum # run days per TSG / TF	2.5	
Milestone weighting for FY15-early FY16 run	0.75	0.25

	TSG / Task Force	FY 15 Milestones	FY16 Milestones	FY15 count	FY16 count	Milestone additional runtime	Forum Idea Count Increment	Nominal TSG / TF run days for single TSG XPs	Nominal TSG / TF run days for multi-TSG XPs	Nominal TSG / TF run days for all XPs (Priority #1 fraction 0.75)	Nominal Priority 1 XP run time	Nominal Priority 2 XP run time
Boundary	Pedestal	R15-1		1	0	0.75	0.5	3.5	1	4.5	3.5	1
	Divertor and SOL	R15-1	R16-1	1	1	1	1	4.5	1	5.5	4	1.5
	Materials and PFCs		R16-2		1	0.25	0	2.5	1	3.5	2.5	1
Core	Macroscopic Stability	JRT-15, R15-3	JRT-16	2	1	1.75	1	5	1	6	4.5	1.5
	Transport & Turbulence	JRT-15, R15-1		2	0	1.5	0.5	4.5	1	5.5	4	1.5
	Energetic Particles	JRT-15, R15-2	R16-3	2	1	1.75	0.5	4.5	1	5.5	4	1.5
Scenarios	Advanced Scenarios and Control	Notable, JRT-15, R15-2, R15-3	JRT-16, R16-4	4	2	3.5	1	7	1	8	6	2
	Solenoid-Free Start-up		R16-4	0	1	0.25	0	2.5	1	3.5	2.5	1
	Wave Heating and Current Drive		R16-3	0	1	0.25	0	2.5	1	3.5	2.5	1
Task Forces	Particle Control	R15-3		1	0	0.75	0.5	3.5	1	4.5	3.5	1
						Total:		40	10	50	37	13

Some statistics on XMP/XP idea submissions:

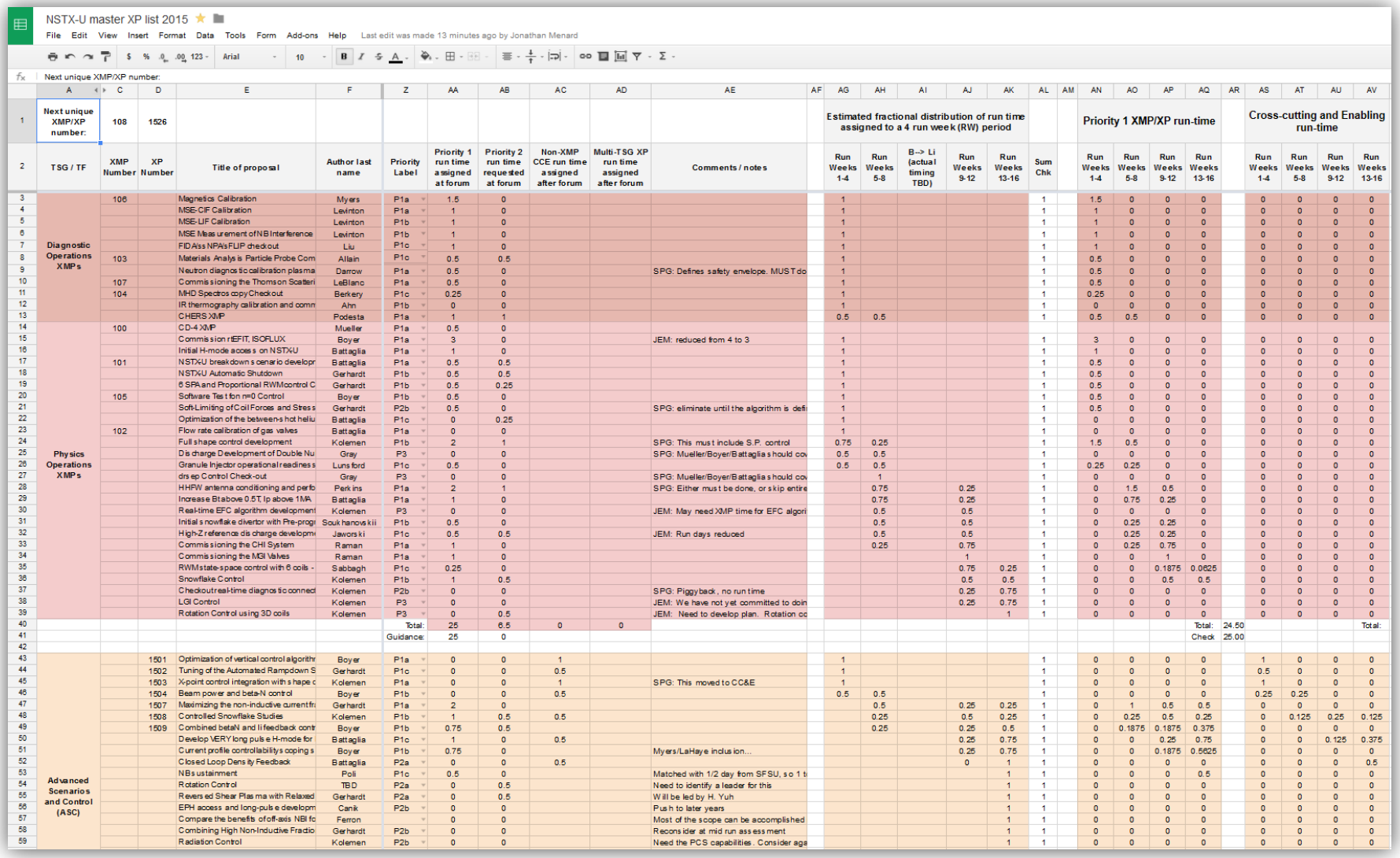
Topical Science Group or Task Force	Run Days Requested	Fraction
Macroscopic Stability (MS)	40.75	14.9%
Cross-cutting and Enabling (CC)	34.85	12.8%
Divertor and Scrape-off-layer (DS)	33.5	12.3%
Advanced Scenarios and Control (ASC)	33	12.1%
Pedestal Structure and Control (PS)	25	9.2%
Particle Control Task Force (PC)	23	8.4%
Energetic Particles (EP)	22.5	8.3%
Turbulence and Transport (TT)	21	7.7%
Materials and PFCs (MP)	15.5	5.7%
Solenoid-free Start-up and Ramp-up (SR)	14.5	5.3%
Wave Heating and Current Drive (RF)	9	3.3%
	272.6	100%

#	Institution	Run Days Requested	Fraction
1	Princeton Plasma Physics Laboratory	112.1	41.1%
2	Oak Ridge National Laboratory	28.5	10.5%
3	Princeton University	20.5	7.5%
4	Lawrence Livermore National Laboratory	18	6.6%
5	General Atomics	17	6.2%
6	ITER (France)	12	4.4%
7	University of Washington	11.5	4.2%
8	Columbia University	10.5	3.9%
9	University of Wisconsin	9	3.3%
10	University of California - Irvine	7.5	2.8%
11	Nova Photonics	6	2.2%
12	University of Illinois	4	1.5%
13	Massachusetts Institute of Technology	4	1.5%
14	University of California - San Diego	3	1.1%
15	Johns Hopkins University	3	1.1%
16	University of Tennessee	2	0.7%
17	Lehigh University	1	0.4%
18	Florida International University	1	0.4%
19	University of California - Los Angeles	1	0.4%
20	University of York (United Kingdom)	1	0.4%
		272.6	100%

Requested / Available Run Time:
Total: 273 / 80 = 3.4×
Research: 248 / 55 = 4.5×

84 unique lead author names

Prioritization, run-time, expected run-month – all documented on "Run Coordination" page on NSTX-U web, shared w/ team



NSTX-U master XP list 2015

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Next unique XMP/XP number:

	A	C	D	E	F	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV
1	Next unique XMP/XP number:	108	1526										Estimated fractional distribution of run time assigned to a 4 run week (RW) period							Priority 1 XMP/XP run-time					Cross-cutting and Enabling run-time			
2	TSG / TF	XMP Number	XP Number	Title of proposal	Author last name	Priority Label	Priority 1 run time assigned at forum	Priority 2 run time requested at forum	Non-XMP CCE run time assigned after forum	Multi-TSG XP run time assigned after forum	Comments / notes		Run Weeks 1-4	Run Weeks 5-8	B--> Li (actual timing TBD)	Run Weeks 9-12	Run Weeks 13-16	Sum Chk		Run Weeks 1-4	Run Weeks 5-8	Run Weeks 9-12	Run Weeks 13-16		Run Weeks 1-4	Run Weeks 5-8	Run Weeks 9-12	Run Weeks 13-16
3	Diagnostic Operations XMPs	106		Magnetics Calibration	Myers	P1a	1.5	0					1					1		1.5	0	0	0		0	0	0	0
4				MSE-CIF Calibration	Levinton	P1a	1	0					1					1		1	0	0	0		0	0	0	0
5				MSE-LIF Calibration	Levinton	P1b	1	0					1					1		1	0	0	0		0	0	0	0
6				MSE Measurement of NB Interference	Levinton	P1b	1	0					1					1		1	0	0	0		0	0	0	0
7				FIDA ss NPA's FLIP checkout	Liu	P1c	1	0					1					1		1	0	0	0		0	0	0	0
8		103		Materials Analysis Particle Probe Com	Allain	P1c	0.5	0.5					1					1		0.5	0	0	0		0	0	0	0
9				Neutron diagnostic calibration plasma	Darrow	P1a	0.5	0			SPG: Defines safety envelope. MUST do		1					1		0.5	0	0	0		0	0	0	0
10		107		Commissioning the Thomson Scatteri	LeBlanc	P1a	0.5	0					1					1		0.5	0	0	0		0	0	0	0
11		104		MHD Spectroscopy Checkout	Berkery	P1c	0.25	0					1					1		0.25	0	0	0		0	0	0	0
12				IR thermography calibration and comm	Ahn	P1b	0	0					1					1		0	0	0	0		0	0	0	0
13				CHERS XMP	Podesta	P1a	1	1					0.5	0.5				1		0.5	0.5	0	0		0	0	0	0
14	Physics Operations XMPs	100		CD-4 XMP	Mueller	P1a	0.5	0																				
15				Commission rtEFIT, ISOFLUX	Boyer	P1a	3	0			JEM: reduced from 4 to 3		1					1		3	0	0	0		0	0	0	0
16				Initial H-mode access on NSTX-U	Battaglia	P1a	1	0					1					1		1	0	0	0		0	0	0	0
17		101		NSTX-U breakdown scenario develop	Battaglia	P1a	0.5	0.5					1					1		0.5	0	0	0		0	0	0	0
18				NSTX-U Automatic Shutdown	Gerhardt	P1b	0.5	0.5					1					1		0.5	0	0	0		0	0	0	0
19				6 SPA and Proportional RWM control C	Gerhardt	P1b	0.5	0.25					1					1		0.5	0	0	0		0	0	0	0
20		105		Software Test for n=0 Control	Boyer	P1b	0.5	0					1					1		0.5	0	0	0		0	0	0	0
21				Soft-Limiting of Coil Forces and Stress	Gerhardt	P2b	0.5	0			SPG: eliminate until the algorithm is defi		1					1		0.5	0	0	0		0	0	0	0
22				Optimization of the between-shot heliu	Battaglia	P1c	0	0.25					1					1		0	0	0	0		0	0	0	0
23		102		Flow rate calibration of gas valves	Battaglia	P1a	0	0					1					1		0	0	0	0		0	0	0	0
24				Full shape control development	Kolemen	P1b	2	1			SPG: This must include S.P. control		0.75	0.25				1		1.5	0.5	0	0		0	0	0	0
25				Discharge Development of Double Nu	Gray	P3	0	0			SPG: Mueller/Boyer/Battaglia should cov		0.5	0.5				1		0	0	0	0		0	0	0	0
26				Granule Injector operational readiness s	Lunsford	P1c	0.5	0					0.5	0.5				1		0.25	0.25	0	0		0	0	0	0
27				dr sep Control Check-out	Gray	P3	0	0			SPG: Mueller/Boyer/Battaglia should cov			1				1		0	0	0	0		0	0	0	0
28				HHFW antenna conditioning and perfo	Perkins	P1a	2	1			SPG: Either must be done, or skip entire			0.75		0.25		1		0	1.5	0.5	0		0	0	0	0
29				Increase Bt above 0.5T Ip above 1MA	Battaglia	P1a	1	0						0.75		0.25		1		0	0.75	0.25	0		0	0	0	0
30				Real-time EFC algorithm development	Kolemen	P3	0	0			JEM: May need XMP time for EFC algori			0.5		0.5		1		0	0	0	0		0	0	0	0
31				Initial snowflake divertor with Pre-progr	Soukhanovskii	P1b	0.5	0						0.5		0.5		1		0	0.25	0.25	0		0	0	0	0
32				High-Z reference discharge developme	Jaworski	P1c	0.5	0.5			JEM: Run days reduced			0.5		0.5		1		0	0.25	0.25	0		0	0	0	0
33				Commissioning the CHI System	Raman	P1a	1	0						0.25		0.75		1		0	0.25	0.75	0		0	0	0	0
34				Commissioning the MGI Valves	Raman	P1a	1	0								1		1		0	0	1	0		0	0	0	0
35				RWM state-space control with 6 coils -	Sabbagh	P1c	0.25	0								0.75	0.25	1		0	0	0.1875	0.0625		0	0	0	0
36				Snowflake Control	Kolemen	P1b	1	0.5								0.5	0.5	1		0	0	0.5	0.5		0	0	0	0
37				Checkout real-time diagnostic connect	Kolemen	P2b	0	0			SPG: Piggyback, no run time					0.25	0.75	1		0	0	0	0		0	0	0	0
38				LGI Control	Kolemen	P3	0	0			JEM: We have not yet committed to doin					0.25	0.75	1		0	0	0	0		0	0	0	0
39				Rotation Control using 3D coils	Kolemen	P3	0	0.5			JEM: Need to develop plan. Rotation co						1	1		0	0	0	0		0	0	0	0
40						Total:	25	6.5	0	0													Total:	24.50				Total:
41						Guidance:	25	0															Check	25.00				
42																												
43	Advanced Scenarios and Control (ASC)		1501	Optimization of vertical control algorithr	Boyer	P1a	0	0	1				1					1		0	0	0	0		1	0	0	0
44			1502	Tuning of the Automated Rampdown S	Gerhardt	P1c	0	0	0.5				1					1		0	0	0	0		0.5	0	0	0
45			1503	X-point control integration with shape c	Kolemen	P1a	0	0	1		SPG: This moved to CC&E		1					1		0	0	0	0		1	0	0	0
46			1504	Beam power and beta-N control	Boyer	P1b	0	0	0.5				0.5	0.5				1		0	0	0	0		0.25	0.25	0	0
47			1507	Maximizing the non-inductive current fr	Gerhardt	P1a	2	0						0.5		0.25	0.25	1		0	1	0.5	0.5		0	0	0	0
48			1508	Controlled Snowflake Studies	Kolemen	P1b	1	0.5	0.5					0.25		0.5	0.25	1		0	0.25	0.5	0.25		0	0.125	0.25	0.125
49			1509	Combined betaN and li feedback contr	Boyer	P1b	0.75	0.5						0.25		0.25	0.5	1		0	0.1875	0.1875	0.375		0	0	0	0
50				Develop VERY long pulse H-mode for	Battaglia	P1c	1	0	0.5							0.25	0.75	1		0	0	0.25	0.75		0	0	0.125	0.375
51				Current profile controllability scoping s	Boyer	P1b	0.75	0			Myers/LaHaye inclusion...					0.25	0.75	1		0	0	0.1875	0.5625		0	0	0	0
52				Closed Loop Density Feedback	Battaglia	P2a	0	0	0.5							0	1	1		0	0	0	0		0	0	0	0.5
53				NBI sustainment	Poli	P1c	0.5	0			Matched with 1/2 day from SFSU, so 1 t						1	1		0	0	0	0.5		0	0	0	0
54				Rotation Control	TBD	P2a	0	0.5			Need to identify a leader for this						1	1		0	0	0	0		0	0	0	0
55				Reversed Shear Plasma with Relaxed	Gerhardt	P2a	0	0.5			Will be led by H. Yuh						1	1		0	0	0	0		0	0	0	0
56				EPH access and long-pulse developm	Canik	P2b	0	0			Push to later years						1	1		0	0	0	0		0	0	0	0
57				Compare the benefits of off-axis NBI fo	Ferron		0	0			Most of the scope can be accomplished						1	1		0	0	0	0		0	0	0	0
58				Combining High Non-Inductive Fractio	Gerhardt	P2b	0	0			Reconsider at mid run assessment						1	1		0	0	0	0		0	0	0	0
59				Radiation Control	Kolemen	P2b	0	0			Need the PCS capabilities. Consider agai						1	1		0	0	0	0		0	0	0	0

2 XP reviews completed last week, 15-20 more (per month) expected for May-July

Outline

- Budget Planning Meeting, Milestones
- FES Community Workshops
- Research Forum Summary
- XP Preparation

First ~25 XPs to review chosen: Order based on Priority 1a (+ few P1b/c) + expected period to be run during campaign

XP number	XP title	Responsible Group	XP author first name	XP author last name	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	P1a	1	0	0	0
1502	Tuning of the Automated Rampdown Software	ASC-TSG	Stefan	Gerhardt	P1c	1	0	0	0
1503	X-point control integration with shape control	ASC-TSG	Egemen	Kolemen	P1a	1	0	0	0
1504	Beam power and beta-N control	ASC-TSG	Dan	Boyer	P1b	0.5	0.5	0	0
1505	Optimizing Boronization XMP	MP-TSG	Charles	Skinner	P1a	0.5	0.5	0	0
1506	Low-beta, low-density locked mode studies	MS-TSG	Clayton	Myers	P1a	0.25	0.75	0	0
1507	Maximizing the non-inductive current fraction in	ASC-TSG	Stefan	Gerhardt	P1a	0	0.5	0.25	0.25
1508	Controlled Snowflake Studies	ASC-TSG	Egemen	Kolemen	P1b	0	0.25	0.5	0.25
1509	Combined betaN and li feedback control	ASC-TSG	Dan	Boyer	P1b	0	0.25	0.25	0.5
1510	Characterizing the SOL Losses of HHFW Powe	RF-TSG	Rory	Perkins	P1a	0	0.5	0.25	0.25
1511	Multi-machine studies of the L-H power thresho	PS-TSG	Michael	Bongard	P1b	0	1	0	0
1512	Characterization of the Pedestal Structure as fu	PS-TSG	Ahmed	Diallo	P1a	0	0.5	0.5	0
1513	Effects of B-> Li transition on the pedestal struc	PS-TSG	Rajesh	Maingi	P1a	0	0.5	0.5	0
1514	Heat flux and SOL width Scaling in NSTX-U	DS-TSG	Travis	Gray	P1a	0	0.25	0.5	0.25
1515	High-beta n=1,2,3 feed-forward error field correc	MS-TSG	Clayton	Myers	P1a	0	0.5	0.5	0
1516	Optimization of PID dynamic error field correcti	MS-TSG	Clayton	Myers	P1a	0	0.5	0.5	0
1517	Neoclassical toroidal viscosity at reduced collis	MS-TSG	S.A.	Sabbagh	P1a	0	0.25	0.5	0.25
1518	RWM PID control optimization based on theory	MS-TSG	S.A.	Sabbagh	P1a	0	0.25	0.5	0.25
1519	Massive Gas Injection Studies on NSTX-U	MS-TSG	Roger	Raman	P1a	0	0	0.5	0.5
1520	Ip/Bt scaling	TT-TSG	Stan	Kaye	P1a	0	0.5	0.25	0.25
1521	Validation of gyrokinetic codes in NSTX-U NBI-H	TT-TSG	Yang	Ren	P1a	0	0.5	0.25	0.25
1522	Beam ion confinement of 2nd NBI	EP-TSG	Deyong	Liu	P1a	0	0.75	0.25	0
1523	Characterization of 2nd NBI line	EP-TSG	Mario	Podesta	P1a	0	0.25	0.5	0.25
1524	AE Critical Gradient	EP-TSG	Bill	Heidbrink	P1a	0	0	0.25	0.75
1525	Rotation effects on CAEs and GAEs	EP-TSG	Neal	Crocker	P1a	0	0	0	1
1526	Establish heat transmission pathways in high-Z	MP-TSG	Michael	Jaworski	P1a	0	0.25	0.25	0.5

- **Are you on the list above? You will be Doodled soon to schedule an XP review**
- **Also want to schedule PC-TF XP reviews – need priority labels from this group**

Jon's guess for possible run-plan for 2015

- July: 2-3 run weeks

FY15: 8-10 run weeks

- August: 3 run weeks (1 week for August vacations)
- September: 3-4 run weeks

Fiscal Year Boundary

- October: 3-4 run weeks
- November: 0-1 run weeks
  - Pause for ST workshop, APS, Thanksgiving
- December: 3 run weeks

6-8 run weeks
(+ another 6-8 RW before end of FY2016)

Summary

- Important FY17 Research (and other) milestones defined
- Strong leadership and participation in community workshops
- Successful Forum, XP prioritization complete, reviews started
- **Exciting run coming up! Thank you for your patience…**