

NSTX-U Core Science Group – Overview and Agendas

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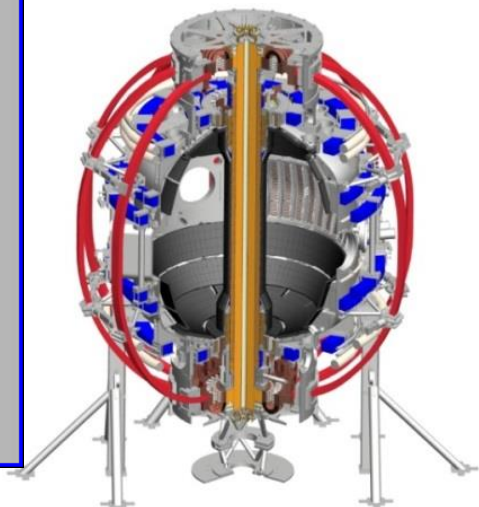
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NSTX-U Research Forum

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PPPL

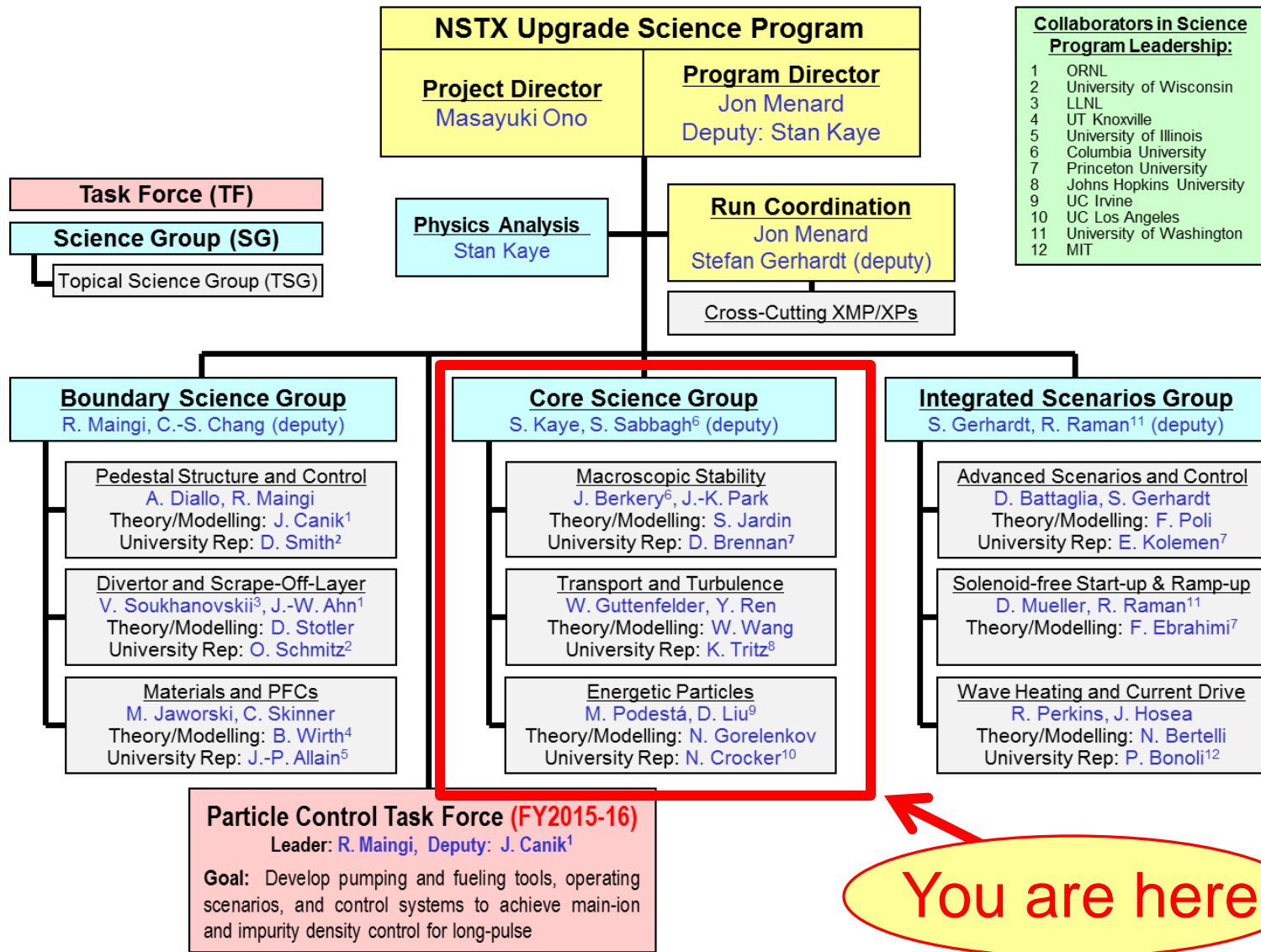
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Core Science Group is composed of Macroscopic Stability, Transport and Turbulence, and Energetic Particle TSGs



Key role of SGs: Coordinate research of TSGs to promote experiments / plans that achieve multiple scientific goals

- ❑ Multiple-TSG experiments identified (for your benefit, be aware)
 1. “Characterization of the 2nd Neutral Beam Injection Line”
 - Present organizer: Mario Podesta (mpodesta@pppl.gov)
 - Objective: to create critical, basic plasma discharges with essential NBI variations of common use for several TSGs
 2. “Basic I_p , B_T variations using the new NSTX-U center column”
 - Present organizer: Stan Kaye (skaye@pppl.gov)
 - Objective: to create initial, basic I_p , B_T variations producing a range of plasma variations of common interest to TSGs (e.g. collisionality)

- ❑ Strong connection to Advanced Scenarios & Control TSG
 - ❑ Linked milestones between Core SG TSGs and ASC
 - ❑ Linked research and device capabilities with ASC as well

Overview of milestones for the Core Science Group TSGs

□ Fiscal year 2015

- JRT-15: Quantify impact of broadened $J(r)$ and $p(r)$ on tokamak confinement and stability
- R15-1: Assess H-mode energy confinement, pedestal, and scrape-off-layer characteristics with higher B_T , I_p and NBI heating power
- R15-2: Assess effects of NBI on fast-ion distribution and NBI current drive profile
- R15-3: Develop physics and operational tools for high-performance discharges (shaping, beta, EF/RWM) (joint with Integrated Scenarios)

□ Fiscal Year 2016

- JRT-16: Assess disruption mitigation, initial tests of real-time warning and prediction techniques (joint with Integrated Scenarios)
- IR16-1: Assess confinement and local transport and turbulence at low v^* with full range of B_T , I_p , and NBI power

Agendas for the Core Science Topical Science Group sessions - Overview

❑ Energetic Particles

- ❑ Tue. 1:30PM – 5:00PM, Room B252
- ❑ 19 XP ideas
- ❑ max. total requested run time: 22.5 days

❑ Macrostability

- ❑ Wed. 9:00AM – 12:30PM, Room B318
- ❑ 36 XP ideas
- ❑ max. total requested run time: 39.75 days

❑ Transport and Turbulence

- ❑ Wed. 1:30PM – 5:00PM, Room B252
- ❑ 19 XP ideas
- ❑ max requested run time: 20 days

Request made to TSG Leaders to produce prioritized XP list by Thu. 10 AM

Agendas for the Core Science Topical Science Group sessions – (i) Energetic Particles (Tue. 1:30PM-5:00PM, B252)

Intro 1:30-1:35pm Podestà *Meeting agenda & XP prioritization process*

Overview of XP ideas

1:35-1:45pm Crocker *UCLA reflectometer array
Rotation effects on CAEs and GAEs*

1:45-2:00pm Liu *FIDA/ssNPA/sFLIP checkout XMP
Beam-ion confinement of the 2nd NBI
Effects of 3D fields on fast ion transport*

2:00-2:05pm Hao *Low-f MHD and fast ion redistribution*

2:05-2:25pm Fredrickson *Parametric dependence of TAE avalanches
TAE with high beta, q_{min}
HHFW suppression of Alfvénic waves
HHFW rotation control & TAE activity
Initial TAE excitation with antenna*

2:25-2:30pm Boeglin *CFP fusion source profile measurements*

2:30-2:40pm Podestà *Summary of remaining XP ideas*

Combination of XP ideas

2:40-3:10pm Podestà + EP-TSG

Break 3:10-3:20pm ...

Prioritization of XP ideas

3:30pm- Podestà + EP-TSG

Agendas for the Core Science Topical Science Group

sessions – (ii) Macro-stability (Wed. 9AM – 12:30PM, B318) #1

Global Stability	Talks	Time
Menard	Assess NSTX-U ideal-wall limit with 2nd NBI	9:10 – 9:14
Berkery	RWM Stabilization Dependence on Neutral Beam Deposition Angle RWM Stabilization Physics at Reduced Collisionality	9:14-9:22
Sabbagh (and for Y.S. Park)	RWM control physics with partial control coil coverage (JT-60SA) RWM PID control optimization based on theory and experiment RWM state space control physics RWM state space active control at reduced plasma rotation	9:22-9:50
NTV		
Sabbagh	Neoclassical toroidal viscosity at reduced collisionality (independent coil control) NTV steady-state offset velocity at reduced torque with HHFW	
Error Fields		
Sabbagh	Multi-mode Error Field Correction with the RWM State-Space Controller	9:50-9:54
Park	Resonant error field threshold with non-resonant braking	
Kolemen	Expand the operational limit by real-time adaptive EFC	9:54-9:58
La Haye for Lanctot	Real-time error field control using extremum seeking in NSTX-U	10:00-10:04
Myers	High-beta $n=1,2,3$ feed-forward error field correction Optimization of PID dynamic error field correction	10:04-10:20
Locked / Tearing Modes		
Myers	Minimum Value of q_{min}/q_0 and q shear to avoid core $n=1$ kink/tearing Low-beta, low-density locked mode studies	
Delgado-Aparicio	Stabilization of radiated-induced tearing modes (RiTMs) using off-axis-heating	10:20-10:24
Okabayashi	Comparative study of the Electro-magnetic torque application through feedback for NTM locking avoidance in DIII-D, RFX-mod and NSTX	10:24-10:28
La Haye	Make contact with NSTX for $n=1$ tearing mode stability Assess β_N and q_{min} $n=1$ tearing stability limits at the increased aspect ratio of NSTX-U	10:30-10:38
Paz-Soldan	Tearing onset through driven reconnection across rational surfaces	10:38-10:42
Kolemen	RMP NTM interaction	10:42-10:46

Agendas for the Core Science Topical Science Group sessions – (ii) Macro-stability (Wed. 9AM – 12:30PM, B318) #2

Locked / Tearing Modes	(continued)	
Sabbagh (for Y.S. Park)	NTM Entrainment in NSTX-U	10:46-10:50
Wang	Study of tearing mode stability in the presence of external perturbed fields	10:50-10:58
Plasma Response		
Wang	Direct measurement of kinetic plasma response using Nyquist Analysis	
Evans	3D plasma response data for MHD and transport code validations	10:58-11:02
Nelson	Increased CHI Start-up Currents through Imposed Non-axisymmetric Perturbations	11:02-11:06
Disruptions		
Sabbagh	Disruption PAM Characterization, Measurements, and Criteria	11:06-11:10
Myers	Disruption halo current studies in NSTX-U	11:10-11:14
Raman (and for Jardin)	Investigation of Plasma Disruptions during Current Rampdown Massive Gas Injection Studies on NSTX-U	11:14-11:22
Eidietis	Using private flux MGI as super-radiative divertor for disruption mitigation Effect of snowflake on divertor heat flux during disruption	11:22-11:30
Izzo	Measure effect of extrinsic asymmetry (poloidal location of injector) on VDE mitigation Study 3D and 0D aspects of locked mode mitigation	11:30-11:38

❑ Discussion and Prioritization of XP Ideas: 11:40AM –

Agendas for the Core Science Topical Science Group sessions – (iii) Transport &T (Wed. 1:30PM-5:00PM, B252)

#	Time	Speaker	XP Title	Req	Min
	1:30	W. Guttenfelder	Intro (priorities, run guidance, diagnostics availability)	-	-
1	1:35	S. Kaye	Ip, BT confinement scaling (R15-1)	3	3
2	1:42	N. Crocker	Investigate core energy transport via HHFW	0.5	0.25
3	1:49	K. Tritz	Correlation of *AE bursts with fast core Te measurements	0.5	0
4			Perturbed edge impurity transport	1	0.5
5	2:01	J. Munoz-Burgos	Core impurity transport at fixed q using ME-SXR	1.5	1
6	2:08	Delgado-Aparicio	Impurity transport in electron RF-heated scenarios	1	1
7			Impurity transport vs. torque in NBI H-modes	1	1
8	2:20	F. Scotti	Characterization of Intrinsic impurity transport in NBI H-modes	0	0
9	2:27	Y. Ren	Perturbative particle transport with SGI in L- and H-modes	1	0.5
10			Validation of GK codes in NBI L-modes	1	0.5
11			Investigate effects of q profile on T&T in H-modes	1	0.5
12	2:42	H. Yuh	Reverse shear confinement with off-axis NBI	2	1
13	2:49	W. Guttenfelder	Perturbative momentum transport in L- and H- modes	1	0.5
14			Investigating influence of rotation profile on T&T	1	0.5
15	3:01	G. McKee	Impact of 3D fields on T&T, ELMs	1	0.5
16	3:08	J.K. Park	Localized 3D field effects on momentum transport and confinement	0.5	0.5
17	3:15	D. Smith	2D observations of GAMs and zonal flows	1	0.5
18			Dependence of low-k turbulence on rho*	1	0.5
19	3:27	N. Mandell	Investigating small-scale edge turbulence with GPI	1	0.5
	-5:00		Prioritizing	Total:	20
					12.75

Agenda for the Core Science Group breakout session (Thu. 1:30PM-5:00PM, B252)

- ❑ Review list of experiments proposed to Macro-stability, Transport & Turbulence, and Energetic Particles TSGs
- ❑ Briefly discuss organization/prioritization of the individual TSG lists
- ❑ Discuss potential run time efficiencies through common run elements across TSGs where they exist
 - ❑ XPs engaging more than one TSG will receive higher priority
 - ❑ Continue to search for basic shot lists that have multiple uses
 - ❑ Check attention to NSTX-U milestones, ITPA needs, 5 Year Plan
- ❑ Produce a list of XP efficiencies agreed upon by the group for run coordination