

# Core SG XP Prioritization

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# Method

- Prioritization by each TSG
  - Folding in Milestones, JRT, ITPA, etc.
  - Based on availability of machine capabilities, diagnostics
- Much discussion about:
  - Combining XPs within TSG
  - Combining/leveraging XPs **across** TSGs (within SG)
- Short discussion about combining/leveraging XPs across **SGs** (already see benefit of SG structure)
  - Discussion preliminary
  - Need to ensure that all interested parties are involved in XP development from get-go

# Energetic Particles

- **Priority 1**
  - Focus on 2<sup>nd</sup> NB
    - Beam ion confinement (Liu): modulated, steady, low voltage, all sources, quiescent L-mode; 15-2, JRT15
    - Characterize 2<sup>nd</sup> beam (Podesta): multi-TSG. base on reliable H-mode fiducial-like discharge, all sources; 15-2, JRT15, ITPA
    - TAE stability vs NB injection: combine with above; ITPA
  - Rotation effects
    - On CAE/GAE (Crocker): effect on mode structure and frequency, run after CAE/GAE scoping in T&T; 15-1, 16-1
    - On TAE gap structure (Podesta): combine with above
  - AE critical gradient (Heidbrink): modulated source to measure incremental fast ion flux with power scan, compare to DIII-D; 15-2
  - Parametric dependence of TAE avalanches (Eric F): piggyback on Podesta, dedicated time for high-beta; 15-1, 15-2
  - HHFW
    - Suppression of Alfvén waves (Eric F): low  $I_p$ , He plasmas; ITPA
    - Effect of rotation on TAE activity (Eric F): does suppressed rotation with HHFW suppress TAEs, combine with above

# Energetic Particles

- **Priority 2**

- Effect of 3D on fast ion confinement/stability (Liu): AB results with enhanced diagnostics, piggyback scoping with MS/ASC
- Modification of fast ions by RF (Podesta): vary RF injection parameters in H-mode, combine with Waves (Bertelli); 16-3
- Light ion beam probe AE transport (Heidbrink): accurate measurement of transport by individual AEs, sFLIP, scope with Ip/Bt

- **Priority 3**

- Effect of low-f on fast ions (Hao): mostly piggyback on Podesta, possibly some MS; 15-2
- Fusion source profiles with proton detector (Boeglin): awaiting hardware, XMP checkout; 15-2
- TAE excitation with antenna (Eric F): awaiting hardware, initially pback
- AE damping of 3D perturbed equilibria (Bortolon): needs TAE antenna

- **Other**

- RF+NBI at low Ip (Poli): combined with SFSU, Waves?
- TAE at high beta,  $q_{\min}$  (Eric F): piggyback high noninductive scenarios in ASC

# EP Summary

#	Author	Title	P1	P2	CCE	Ex	Comment
1	Liu	Beam confinement of 2 <sup>nd</sup> NBI	1.5				
2	Podesta	2 <sup>nd</sup> NB characterization	2		2		
3	Podesta	TAE stability					Piggyback with #2
4	Crocker	Rotation effects on CAE/GAE	0.5				Run after T&T CAE/GAE scoping
5	Podesta	Modify TAE gaps					Combine with 4
6	Bill H	AE critical gradient	0.5			0.5?	Run after 1,2 and Ip/Bt scan
7	Eric F	Parametric dependence of TAE avalanches	0.5				Piggyback on 2
8	Eric F	HHFW suppression of AEs	0.5			0.5 ?	Scope out with Waves XP
9	Eric F	HHFW rotation control of TAE activity					Combine with 8
10	Liu	Effects of 3D on fast ion confinement		0.5		0.5 ?	Piggyback on MS/ASC XPs
11	Podesta	Modification of fast ion distribution by RF		0.5		0.5 ?	Combine with Waves XP
12	Bill H	Light ion beam probe of AE transport		0.5		0.5 ?	Scope with Ip/Bt
13	Hao	Effect of low-f on fast ions					0.25 P3
14	Boeglin	Proton detector					1 PR 3 after hardware, XMP
15	Eric F	TAE excitation with antenna					1 PR 3 after hardware, XMP
16	Bortolon	AE damping in 3D equilibria					Combine with 15
17	Poli	RF-NB interaction at low Ip				0.5 ?	Combine with SFSU
18	Eric F	TAE at high beta, q~2					Piggyback on NI scenarios

<b>Total</b>	5.5	1.5	2
<b>Guidance</b>	4	1.5	

# Transport and Turbulence

- **XMPs**
  - Demonstrate Ne puff non-perturbing
  - Demonstrate capability to perform particle transport XP using SGI
- **Priority 1**
  - Ip/Bt scaling (Kaye): multi-TSG, fixed power, B+Li components, extend range of Ip & Bt as allowed; 15-1
  - Perturbative particle transport with SGI (Ren): L- and H-modes; PAC, Thrust 2
  - Validation of GK codes in L (Ren): combine with above, L-mode scenario development time needed?; ITPA, Thrust 2 & 3
  - Perturbative momentum transport (Guttenfelder): in L and H, piggyback with Ren, B->Li in H (PCTF); ITPA, Thrust 2
  - Impurity transport
    - Core (Munoz-Burgos): Ne puff, pback with Ip/Bt, Podesta 2<sup>nd</sup> NB; 15-1, ITPA
    - vs torque (Luis D-A): Ne puff in NBI ELM-free H-modes, pback with 2<sup>nd</sup> NB, Macro; 15-1
    - Intrinsic impurity transport (Scotti): NBI H-mode, pback with Ip/Bt and others; 15-1, JRT15

# Transport and Turbulence

- **Priority 2**

- Reverse shear with off-axis NB (Yuh): T&T+ASC; 15-2, 3, JRT15
- Effect of q-profile on T&T (Ren): pback with ASC, EP; JRT15
- Edge turbulence with GPI (Mandell): pback with Ip/Bt, possibly use B->Li (PCTF)
- AE bursts with fast Te measurement (Tritz): e<sup>-</sup> transport, pback early
- 2D GAMs & ZFs (Smith): in L, pback with Ren L, Liu EP
- Edge impurity transport with ELM pacing (Tritz): 3D, LGI, Ne puff, pback with Ped?
- Effect of rotation profile on T&T (Guttenfelder): pback with Macro, ASC, EP: ITPA
- 3D fields on T&T (McKee): BES, pback with Ped, Macro?
- Localized 3D effects on T&C (JK Park): pback with Evans (Macro), dedicated T&T run time pending

- **Priority 3**

- Core energy transport w/ HHFW (Crocker): need to heat e<sup>-</sup> with RF in H-mode; distinguish between stochastic transport, GAE/KAW channeling; 16-1
- Impurity transport with RF e<sup>-</sup> heating (Luis D-A): scope with RF XPs, need high-k
- Dependence of low-k turbulence on rho-star (Smith): need well-conditioned dimensionless parameter match; 16-1

# T&T cont'd

#	Author	Title	P1	P2	CCE	Ex	Comment
1	Kaye	Ip/Bt scaling	2		2		
2	Ren	Particle transport with SGI	0				Combine with 3 pending SGI XMP, Liu (EP)
3	Ren	Validation of GK codes in L-mode	1				Combine with 2, Liu (EP)
4	Guttenfelde r	Momentum transport in L and H	0.5			0.5 ?	L-mode with Ren, B->Li (Ped) ?
5	Munoz-Burgos	Core impurity transport	0.5			0.5 ?	Pending Ne puff XMP, joint with Ip/BT 2 <sup>nd</sup> NB?
6	Luis D-A	Impurity transport vs torque in H	0.5			0.5?	Run after 1,2 and Ip/Bt scan, Ne puff
7	Scotti	Intrinsic impurity trans.					Piggyback with Kaye, others
8	Yuh	Reverse shear with off-axis NB		0.5		0.5 ?	With ASC?
9	Ren	Effect of q-profile on T&T				1 ?	With ASC, EP, #8
10	Mandell	Edge turbulence with GPI		0.25		0.25 ?	With Ped ?
11	Tritz	AE bursts with fast Te		0.5			0.25 P3
12	Smith	2D obs of GAMS and ZFs		0.5		0.5 ?	Piggyback with Ren (#3), Liu (EP), ASC (Helium)
13	Tritz	Perturbed edge impurity transport				0.5 ?	Ne puff, 3D fields, LGI; w/ Ped?
14	Guttenfelde r	Rotation profile on T&T					Combine with 15
15	McKee	Impact of 3D on T&C				0.5 ?	Pback with Ped
16	JK Park	Localized 3D effects		0.5*		0.5	With MS (Evans), individual EF/RWM coil control, dedicated time pending

**Total** 4.5 2.25 2  
**Guidance** 4 1.5



# Macro

- CCE (needed by Team): requesting additional run time
  - RWM PID control optimization (Sabbagh); 15-3
  - Realtime adaptive RF control (Kolemen): XMP?
  - Low beta, low density locked mode studies (Myers): aimed at startup; 15-3
- Priority 1
  - EF/Locked Modes
    - Resonant error field threshold with non-resonant braking (JK Park): uses 6 SPAs, ohmic early, NBI late; ITPA
    - TM stability in presence of 3D (Z. Wang): effect of rotation, combine with above
    - High-beta,  $n=1-3$  feed forward EF control (Myers): scope EF in high performance long-pulse H-modes; 15-3
    - Optimize PID dynamic EF control (Myers): high beta H-modes; 15-3
    - Stabilization of radiation-induced TMs with off-axis heating (Luis D-A): w & w/o Ne puff in H-mode, no lithium; JRT15, 16
    - $n=1$  TM stability (LaHaye): touch base with NSTX, NSTX op parameters, Li

# Macro

- Priority 1 (cont'd)
  - RWM/ NTV
    - RWM stability dependence on NB (Berkery): leverage of 2<sup>nd</sup> NB XP, vary beam source, energy, n=3 to slow plasma; R15-2, 15-3
    - RWM stability at reduced collisionality (Berkery), combine with above, Ip/Bt scoping; 15-3
    - RWM state space control physics (Sabbagh): uses 6 independent SPAs; 15-3, ITPA
    - NTV at reduced collisionality (Sabbagh); 6 independent SPAs
  - 3D plasma response data for MHD and transport code validations (Evans): vary coil combinations, applied n (mostly 2 and 3) to vary rotation and study plasma response in L and H, combine with Park T&T
  - MGI (Raman): XP following XMP, prepare for JRT16, additional run day from DR if needed

# Macro

- Priority 2

- NTM

- E-M torque application for NTM locking avoidance (Okabayashi): torque through phase shift between applied  $n=1$  and excited TMs, compare to DIII-D, RFX
    - NTM entrainment (YS Park): slow plasma with  $n=3$ , use  $n=1$  to maintain  $n=1$  rotation to avoid locking; 15-3, JRT16, ITPA

- RWM/NTV

- RWM control physics with partial control coil coverage (YS Park); ITPA
    - RWM state-space active control at reduced rotation (YS Park); ITPA
    - NTV at reduced torque with HHFW (Sabbagh): leverage off Waves (Bertelli); 15-3
    - Multi-mode error field correction with the RWM state-space controller (Sabbagh); 15-3, ITPA

- Ideal wall limit with 2<sup>nd</sup> NB (Menard): assess varying rotation profiles; 15-3

- Direct measurement of plasma response using Nyquist Contour (Z. Wang): investigate drift kinetic effects, measure  $n=1, 2$  plasma response at high beta (different responses?) using range of applied frequencies, code benchmarking (MARS-F/K); ITPA

# Macro

- **No run time, but important**
  - Disruption PAM studies (Sabbagh)
  - Disruption halo current studies (Myers)
  - Disruptions during current rampdown (Jardin): fiducials?, mid run assess.
- **Leverage off ASC XPs**
  - Role of  $q$ -, rotation profiles on core  $n=1$  kink/tearing (Myers)
  - Assess  $\beta_{tan}$ ,  $q_{min}$  on  $n=1$  tearing in  $-U$  (LaHaye): also 2016?
- **No run time allocated**
  - RMP/NTM interaction (Kolemen): pback with LaHaye
  - Tearing onset through driven reconnection on rationals (Paz-Soldan): pback with LaHaye
  - Real-time EF control (Lanctot): pback on Myers high beta
  - 3D application to enhance CHI (Nelson): shuffled off to SFSU
  - Disruption heat loads with snowflake (Eidetis): pback with SF?
  - Use PFR as super-radiative divertor (Eidetis): work with RR
  - MGI injector location on VDE mitigation (Izzo): 2016?
  - 3D and 0D aspects of locked mode mitigation (Izzo): 2016?
  - Off axis NBI for advanced scenarios (Ferron): compare to DIII-D, leverage of Mario, ASC, DIII-D/NSTX-U similarity expts in 2016?

# Macro Summary

Author	Title of proposal	P1	P2	CCE	Ex	DR	Notes
Myers	Low-beta, low-density locked mode studies			0.5			Needed by team
Sabbagh	RWM PID control optimization based on theory and experiment			0.5			Needed by team
Kolemen	Expand the operational limit by real-time adaptive EFC			0.5			Requesting time. XMP? Thursday evening session?
Raman	Massive Gas Injection Studies on NSTX-U	1				1	One extra day Director's reserve?
Berkery	RWM Stabilization Dependence on Neutral Beam Deposition Angle	0.5					
Sabbagh	RWM state space control physics	0.5					
Sabbagh	Neoclassical toroidal viscosity at reduced collisionality (independent coil control)	0.5			0.5		Extra half day from Mario's 2 days of CCE time.
Park	Resonant error field threshold with non-resonant braking	0.5					combine with 26
Myers	High-beta n=1,2,3 feed-forward error field correction	0.5					
Myers	Optimization of PID dynamic error field correction	0.5					
Luis D-A	Stabilization of radiated-induced tearing modes (RITMs) using off-axis-heating	0.5					
La Haye	Make contact with NSTX for n=1 tearing mode stability	0.5					
Evans	3D plasma response data for MHD and transport code validations	0.5			0.5		The ex-TSG extra half comes from J.-K. Park's T&T priority 2.
Sabbagh	Disruption PAM Characterization, Measurements, and Criteria	0					Zero run time, but important to do
Myers	Disruption halo current studies in NSTX-U	0					Zero run time, but important to do
Jardin	Investigation of Plasma Disruptions during Current Rampdown	0					Zero run time, but important to do. Mid-run assessment? 0.25 days?
Myers	Minimum Value of $q_{min}/q_0$ and $q$ shear to avoid core n=1 kink/tearing				0.5		with ASC?
La Haye	Assess betaN and $q_{min}$ n=1 tearing stability limits at the increased aspect ratio of NSTX-U				0.5		with ASC? 2016?
Okabayashi	Comparative study of the Electro-magnetic torque application through feedback for NTM locking avoidance in DIII-D, RFX-mod and NSTX		0.25				these two NTM entrainment XPs have commonality, should work together
Y.S. Park	NTM Entrainment in NSTX-U		0.25				these two NTM entrainment XPs have commonality, should work together

# Macro Summary

Author	Title of proposal	P1	P2	CCE	Ex	DR	Notes
Wang	Direct measurement of plasma response using Nyquist Contour		0.5				
Menard	Assess NSTX-U ideal-wall limit with 2nd NBI		0.5				
Y.S. Park	RWM state space active control at reduced plasma rotation		0.5				
Sabbagh	Multi-mode Error Field Correction with the RWM State-Space Controller		0.5				
Y.S. Park	RWM control physics with partial control coil coverage (JT-60SA)		0.25				
Sabbagh	NTV steady-state offset velocity at reduced torque with HHFW		0.25				Leverage off Bertelli?
Berkery	RWM Stabilization Physics at Reduced Collisionality						combined with other Berkery XP
Kolemen	RMP NTM interaction						piggyback on La Haye's
Paz-Soldan	Tearing onset through driven reconnection across rational surfaces						piggyback on La Haye's
Lanctot	Real-time error field control using extremum seeking in NSTX-U						piggyback on Myers' "High-beta n=1,2,3 feed-forward error field correction"?
Wang	Study of tearing mode stability in the presence of external perturbed fields						combined with J.-K. Park's
Nelson	Increased CHI Start-up Currents through Imposed Non-axisymmetric Perturbations						piggyback on CHI
Eidietis	Effect of snowflake on divertor heat flux during disruption						possible piggyback on snowflake?
Eidietis	Using private flux MGI as super-radiative divertor for disruption mitigation						work with Roger
Izzo	Measure effect of extrinsic asymmetry (poloidal location of injector) on VDE mitigation						work with Roger, and 2016?
Izzo	Study 3D and 0D aspects of locked mode mitigation						work with Roger, and 2016?
Ferron	Compare the benefits of off-axis NBI for advanced scenarios in low and medium aspect ratio devices						leverage off of Mario's?
<b>Total</b>		5.5	3	2		1	
<b>Guidance</b>		4.5	1.5				