

Planning of initial Div SOL TSG experiments

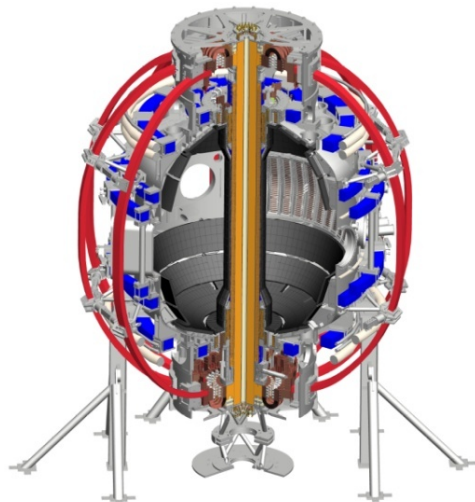
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and the NSTX Research Team

NSTX-U Pre-Forum Meeting 2
PPPL
29 January 2015

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DivSOL TSG leads and/or contributes to several milestones in 2015 and 2016

- **FY 2015**

- **R(15-1)**: Assess H-mode energy confinement, pedestal, and scrape off layer characteristics with higher B_T , I_P and NBI heating power
- **R(15-3)**: Develop the physics and operational tools for obtaining high-performance discharges
- **IR(15-1)**: Develop and assess the snowflake divertor configuration and edge properties

- **FY 2016**

- **R(16-1)**: Assess scaling and mitigation of steady-state and transient heat-fluxes with advanced divertor operation at high power density
- **R(16-2)**: Assess high-Z divertor PFC performance and impact on operating scenarios

Initial XMPs and enabling activities (1st month)

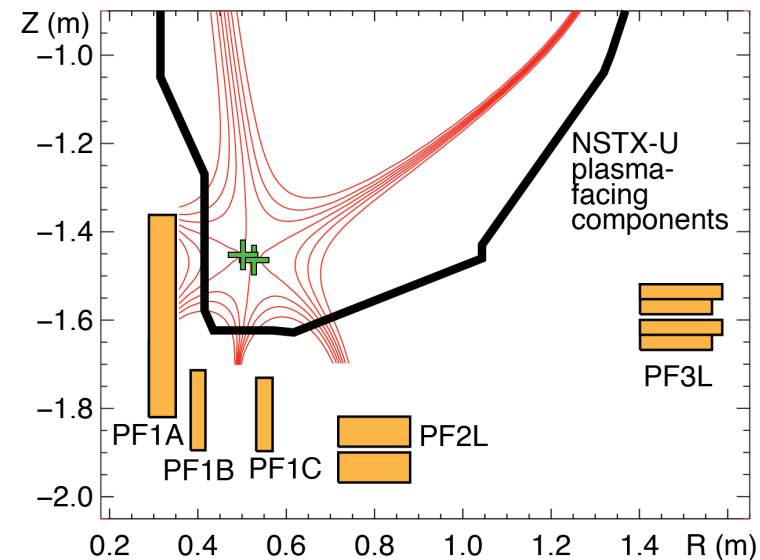
- Diagnostic and system commissioning and calibrations
 - Calibrate and commission IR thermography
 - During bakeout, compare to thermocouples, evaluate surface layer effects
 - NBI power scan, I_p scan
 - Commission other SOL and divertor diagnostics (mostly piggy-back)
 - GPI, Langmuir probes, spectroscopy, cameras, bolometers, RGA, etc
- Contribute to multi-TSG XMPs
 - Gas injector commissioning, including divertor and SGI (with D_2 and impurity)
 - Calibrate neutral pressure gauges (dedicated shots)
 - Develop fueling scenarios (all LFS, SGI, HFS, divertor, etc)
 - Develop low, medium, high triangularity shapes, DN shapes, etc
 - With X-point and strike point control
 - Develop snowflake divertor configuration with pre-programmed coil currents and gap control, and start on feedback control algorithm

Initial XP 1 - SOL and divertor characterization (2nd month, 2-3 days, with PED, M&PFC, PCTF, ASC)

- Goals:
 - provide input to R15-1 and R15-3 and initial development for R16-1 and R16-2
 - Enable divertor and SOL characterization under boronized conditions (to cf. with lithium)
 - enable dedicated XP development after 2 months
- Boundary conditions
 - $P_{\text{NBI}} = 1\text{-}6 \text{ MW}$ and $6\text{-}12 \text{ MW}$; $I_p = 0.7\text{-}1 \text{ MA}$ and $1\text{-}1.4 \text{ MA}$; $n_e = (0.5 - 0.8) \times n_G$
 - Boronized vs Lithium
 - D_2 and impurity seeding for radiative divertor
 - 3D fields
 - Shaping (high triangularity vs low triangularity) and magnetic balance (LSN vs DN)
- Deliverables
 - Divertor peak heat flux scaling and initial assessment of power balance, in-out assym.
 - Initial assessment of SOL power width scaling (I_p , S , L_{\parallel} , ...)
 - Initial assessment of SOL and divertor turbulence
 - ELM type identification and ELM regimes, ELM heat fluxes and profiles
 - Characterize operating space of partially detached outer strike point
 - Initial assessment of impact of 3D fields on divertor asymmetries, SP splitting, etc
 - Assessment of divertor conditions and plasma-surface interactions for R16-2

Initial XP 2 - Snowflake divertor (with PED, ASC, PCTF)

- Goal: enable initial data in FY15 and timely development for R16-1
 - Obtain SF configurations with pre-programmed currents
 - Use gap control initially
 - Use X-point or SP control from PCS
 - Use NSTX algorithm and ISOLVER modeling with unipolar PF 1A and PF2, bi-polar PF 1C
 - Develop control algorithm of inter-null distance and segment orientation
 - Evaluate pedestal and divertor plasma as function of inter-null distance
 - Assess SF utility for ELM control
 - Assess impact of 3D fields on SF
 - Assess radiative SF
 - Assess SOL power width with I_p scaling



Backup

Run schedule assumptions

FY15			Early FY16	
Run Weeks 1-4	Run Weeks 5-8	Run Weeks 9-12	Run Weeks 13-16	17-18
Commissioning	Science	Science	Science	



Mid-run assessment



Scope of pre-forum meeting #2 - see next page for additional details



Scope of Research Forum

- Pre-forum meeting #2 should emphasize XMP/XP title, goal, author identification to cover first 2 run months (Weeks 1-8)
- Forum should emphasize prioritization of XPs for weeks 3-18, but also document commissioning XMP/XP goals + run-time
- Mid-run (re-)assessment after first 6-8 Science run-weeks

Assumptions for first 2 run-months to use in identifying XMP/XP titles/goals/authors for Jan 29th pre-forum meeting #2

- Machine Commissioning...assume 1 month (run weeks 1-4)
 - Develop basic breakdown, current ramp, shape/position control, diverted plasmas, H-mode access, basic fuelling optimizations.
 - Goal: 1 MA, 0.5 T, NBI-heated H-mode (i.e. ~NSTX fiducial levels)
 - Diagnostic commissioning
 - Boronized PFCs
 - Mostly XMPs
 - **What science (aka XPs) can be done during this phase?**
- 1st Month of Science Campaign (run weeks 5-8)
 - Boronized PFCs, possibly begin lithium coatings
 - Operations and basic profile diagnostics, neutron rate,...
 - Operation up to 1.4 MA and 0.65 T, 2 seconds
 - 6 beam sources up to 90 kV
 - HHFW available for commissioning
 - **What critical XPs can/should be done during this phase?**