

Systematic study of NSTX divertor regimes



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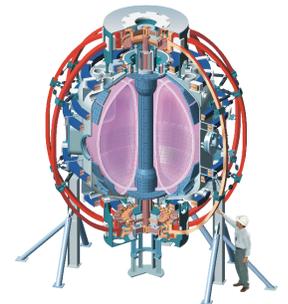
NSTX Research Team

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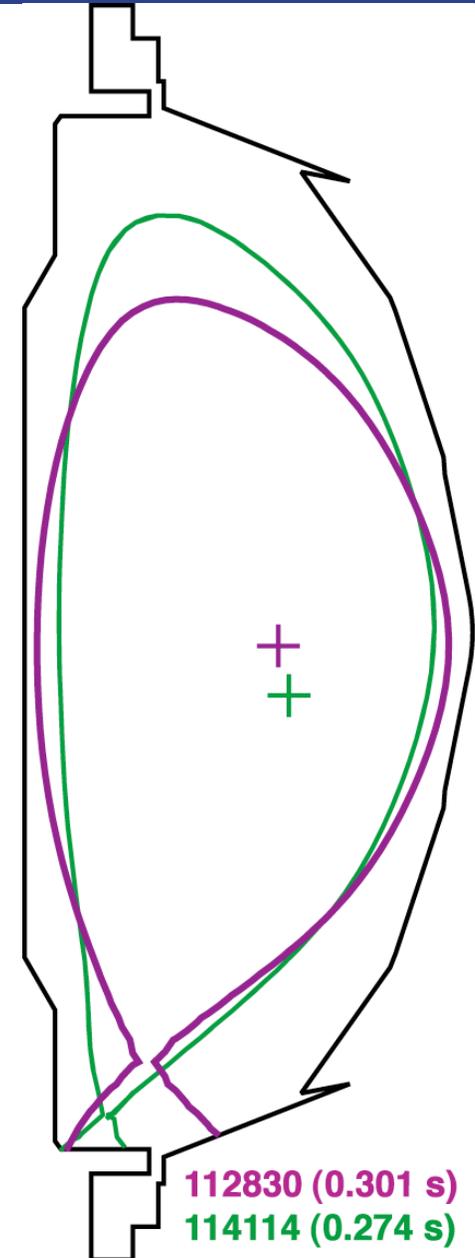
XP 438 status and results in FY'04

- XP was delayed for months due to D_γ filter availability issues
- Obtained only 3.5 hours due to lack of machine run time
- Out of 9 pulses, 2 pulses had machine problems
- Plan for XP originally included D_2 and Ne injection scans in L-mode to obtain edge n_e (i.e. v_{SOL}^*) scan and edge P_{rad} scan. Had to settle for a crude D_2 injection scan.
- Obtained a 2 NBI source L-mode: possible if LFS gas is $\Gamma > 50 \text{ Torr l / s}$ and $P_{NBI} = 2 - 3 \text{ MW}$
- LDGIS proved to be too fast and disruptive for a systematic scan
- Inner divertor detachment threshold in $\langle n_e \rangle$, P_{in} space is low ($n_e > 2 - 3 \times 10^{19} \text{ m}^{-3}$, $P_{in} = 1.4 \text{ MW}$)
- Have not been able to detach outer divertor with D_2 $\Gamma_{LFS} < 120 \text{ T l / s}$, $P_{NBI} 4 \text{ MW}$
- Similar in L- and H-mode plasmas

Wide parameter range LSN plasma available in 2004

	112830 (PF2L)	114114 (PF1B)
κ	1.85	2.40
δ	0.47	0.74
drsep	-1.8	-1.0*
q_{edge}	13	9.5

- Only LSN divertor can be studied at present, DN divertor in FY'05 - FY'06
- **PF1B coil LSN shape** (comp. to **PF2L**):
 - has **~ 1.5** connection length - beneficial for detachment
 - OSP magnetic flux expansion is **~ 10** (cf. 4)
 - inner divertor detaches at lower density
 - outer always attached



Request one day for XP 438 in FY'05

- XP Goals unchanged: Identify divertor regimes, determine boundaries in operational space, determine rel. role of SOL parallel heat transport channels (e-i, conduction, convection)
- Develop radiative divertor regime compatible with high performance long H-mode plasmas
- XP is ready for execution, all required diagnostics operational
- Emphasize desire to have midplane and divertor Langmuir probes
- Consider executing XP with a PF1B or PF1A LSN shape
- Consider executing XP using an H-mode plasma, if access reproducible
- Run plan unchanged - 1/ inject D_2 in increasing quantities (20 - 150 Torr L / s in steady state) to scan edge collisionality and edge radiated power 2/ inject neon in increasing quantities up to $P_{\text{rad}}/P_{\text{in}} \sim 0.5$ and measure midplane and divertor T_e , n_e , heat and particle fluxes
- Analysis will include comparison of experimental database with the Two Point Model and UEDGE simulations.