Ideas for NSTX Research Forum ‘03

S. M. Kaye

NSTX Research Forum

12 Sept. 2003

Counter-injection

- A tool that can benefit most ETs
  - MHD: Rotation effects on MHD stability
  - T&T: Generate large E_r (reduce L-H threshold power), Rotation effects on core microturbulence, Outward heat pinch (beam-thermal friction, a la Houlberg), High core confinement (improve performance).
  - MHD: Rotation effects on MHD stability
  - Boundary: Edge E_r effects on edge turbulence
  - Fast Particles: Beam deposition, heating, importance of non-adiabaticity
  - RF: Reverse B_T/I_p for phasing studies
- Large losses are anticipated, even at 1 MA
  - This generates the large E_r
- Operate at max I_p (>1 MA) first to determine actual loss, heat flux to walls
  - Reverse both I_p and B_T
  - Reduce I_p gradually to increase loss and E_r

Intra-Machine Aspect Ratio Scaling (XP was approved)

- Generate equilibria in ratio range of A=1.25 to 2.0 to assess confinement as a function of aspect ratio
  - Investigation in OH and NBI at fixed R, q^*, β_n, κ
  - Results will help to identify optimal R/a for NSTX c-s upgrade, NSST designs

- At fixed R, q^*, κ

  $\tau_E \propto A^{-1}$ (neo-Alcator scaling)

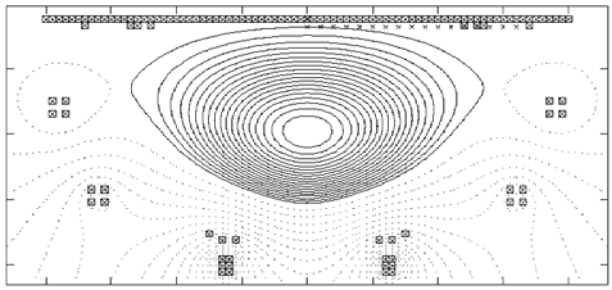
  $\tau_E \propto A^{-1.8}$ (L-mode scaling)

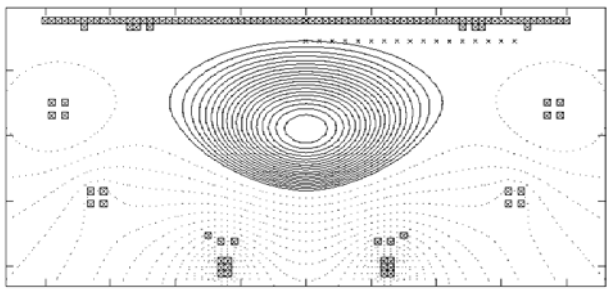
  $\tau_E \propto A^{-3.3}$ (H-mode scaling)

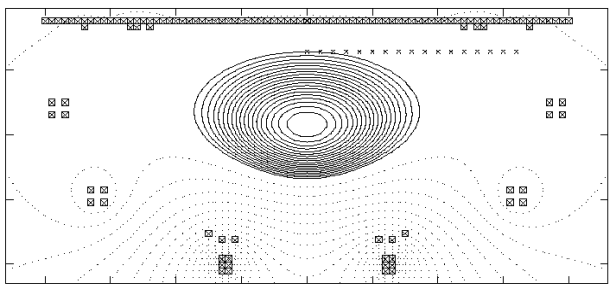
- Fixed R-a: beams miss highest R/a equilibrium
- Fixed R+a: beam losses too high for higher (lower) R/a (I_p)

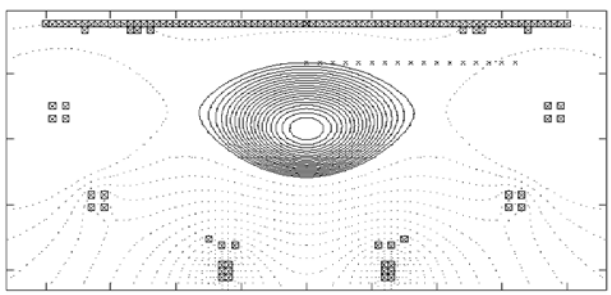
Fixed R equilibria can be produced, but near PF coil current limits at highest R/a

A	a (cm)	I_p (MA)	κ_x/δ_x	q^*/β_n	PF1 (kA)	PF2 (kA)	PF3 (kA)	PF5 (kA)
1.25	67	1.00	2.1/0.3	2.8/2.0				
1.5	57	0.70	2.1/0.3	2.7/2.0	4.2	9.6	-4.6	-7.6
1.65	51	0.55	2.1/0.3	2.6/2.0	6.8	12.4	-4.1	-7.2
1.85	46	0.45	2.1/0.3	2.6/2.0	10.0	17.2	-4.9	-6.6









Issues

- Shape production
  - PF coil currents near limits
- Vertical stability
  - An issue for k=1.9-1.9
  - Cannot run at lower k (required PF coil currents exceed limits)
  - If vertically stable plasmas cannot be produced at R/a=2.0 or 1.75, XP will be abandoned