Prospective on 2003 Transport & Turbulence Research

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Power balance puzzle ($T_i >> T_e$ -> $\chi_i < 0$ with NBI)

- Diagnostic corrections: $T_e \uparrow$ and $T_i \downarrow$ (especially at r/a > 0.6);
  CHERS profiles still difficult at low power
  Use new multi-chordal XCS for CHERS cross check at few points

- In some high power shots T_i/T_e decreased and $\chi_i > 0$;
  T_i/T_e possibly reduced also at lower power (XP223)
  - Did field error play a role? Use new error field control capability to revisit
  - 'High T_i/T_e' shots have been LSN, while 'low T_i/T_e' DND or LSN ? Check

- $T_i/T_e < 1$ in MAST, at V_b= 40 kV; comparison XPs

- 02 XPs addressed possible CAE heating and anomalous e/i coupling
  - Jon Menard's 'streamer heating' hypothesis
  - Neo-classical viscous heating hypothesis (Houlberg); counter injection XPs

- Perturbative transport XPs: impurity and 'cold pulse' χ_e with new pellet injector

Global/local transport and turbulence scaling

- Overall confinement above L-, H-mode scaling (S Kaye)
  MAST confinement within conventional scaling; comparison XPs

- H-mode threshold still not within scaling; continue investigating/modifying ELMs

- Indications that in one class of discharges (high triangularity, DND) confinement (good and improves steadily with time) defies L-mode scaling:
  - weak or no I_p scaling
  - decrease with n_e, then sudden increase (electrons) at low n_e (reversed shear ?)
  - faster P_{input} degradation at 4.5 kG, then no degradation (to a threshold) at 6 kG
  - only small confinement increase at L-H transition
  - peripheral (ion) turbulence depends strongly on B_t

Try other configurations (LSN might give longer pulse), δ, κ
Determine P_{input} scaling as function of B_t
Re-examine low n_e discharges for reversed shear with MSE
MAST and D III comparison XP
Determine H-mode confinement scaling

Assessment of confinement at low-A, high β, large shear

- More hints that predicted ion channel improvement occurs at low A

- Aspect-ratio scaling not clear yet
  - intra-machine A scaling XP approved (challenging)
  - DIII-D comparison XP very useful

- Beta/beta-prime effects not clear yet
  Dimensionless scaling (beta and rho-star) XP (needs RF)

- Shear effects also not clear
  - hints that impurity transport changes (after field error correction, with M_{in})
  - ion channel 'burried' under electron channel ?
    Counter injection XPs
    Use error field control capability to modify shear

- More hints that electron channel is largely dominant in NSTX
  Is this low B or low A effect ? Aspect ratio XP
  Related to short wavelength turbulence ? High-k fluctuations XPs

Proposed 2003 milestones

1. Measure and analyze the dispersion of edge heat flux and assess the impact on plasma facing component requirements
under high heating power in NSTX.
Peripheral transport scaling with ELMs
Transport scaling XPs
Operational limit XPs

2. Explore and characterize plasmas with high beta near the no-wall stability limit simultaneously with high energy confinement for duration greater than the energy confinement times.
Transport scaling XPs
Operational limit XPs

3. Assess interactions between plasma resonant field responses, correction field, and plasma rotation.
Shear effect XPs
Anomalous ion heating XPs

Proposed T&T Agenda

8:30	Dan Stutman	Transport scaling experiments
9:00	Stan Kaye	Counter-Injection Experiments
9:15	Stan Kaye	Aspect ratio scaling experiment
9:30	Rajesh Maingi	MAST and DIII-D comparisons
10:00	Rajesh Maingi	NBI density limits
10:45	Charles Bush	H-mode experiments
11:15	Hyeon Park	ETG and ITG studies
11:45	Ricky Maqueda	GPI experiments
12:00	Stewart Zweben	Edge turbulence control

(Thanks to Stewart Zweben !)