The NSTX Forum Structure, and 2002 Research Milestones and Goals

E.J. Synakowski

NSTX Research Forum

November 28 - 30, 2001

This Forum is an important step in our program planning

- Forward looking
  - Consider program vision, research milestones, experimental capabilities
- Discussions of research ideas in breakout sessions will be key
- Output: outline of a suggested research strategy
  - Balance between lots of good individual ideas and developing a sensible plan given limited run time
  - Identify overlaps & gaps
  - Make connections between researchers of like interests

Six experimental task (ET) groups will play a key role in developing the run plan

- Integrated Scenario Development (Gates, Sabbagh)
- MHD (Menard, Fredrickson)
- Transport and Turbulence (Darrow, Stutman)
- HHFW (Wilson, Swain)
- CHI (Raman, Mueller)
- Boundary Physics (Kugel, Bush)

Our research and our milestones have to be aligned

Integrated Scenario Development Group

- A response to the need to focus on longer pulse and high performance
- Milestones
  - FY 03: *Explore ST plasmas with high τ_E and high beta for $\Delta t >> \tau_E$*
  - FY 03: *Assess the effectiveness of a combination of non-inductive techniques*
- Exploration
  - Long pulse, high beta, high confinement: how do we get there?
    - e.g. low I_p, long pulse HHFW H mode: make a good target for NBI?
    - Development of low l_i targets in this ET
  - Control system development: a home
  - RWM stabilization studies: if mature enough, then there is a home here, if not right away
- We need to discuss how this group relates to the other five

Milestones and goals (con't)

MHD

'02 Milestone: *Measure and analyze the global stability of spherical torus plasmas at high beta without active external control*

- We are well on our way
- New emphasis on assessing role of field errors

– '02 Goal: Scientific assessment of MHD mode stabilization strategy

– '03 Milestone: Engineering assessment of mode stabilization strategy (final design review)

- Possible range of topics
  – ID of beta-limiting modes
  – Fast-ion-induced MHD (inter, intra-machine); particle losses from MHD
  – Stochastic heating effects of MHD
  – NTM physics (inter-, intra-machine)
  – RWMs

Milestones and goals (con't)

Transport & turbulence

- FY '02: *Assess the effects of very high beta and plasma flow on heat loss in spherical torus plasmas*

  ⇒ Are the experiments proposed adequate to address this?

  How can we begin to address the flow shear question?

  Is there a sensible beta scan in the plan?

  Is there a role of B_T variations up to 6 kG with adequate flattop?

Development of the H mode as a long pulse scenario:

We should consider the ISD group as the appropriate place

- Other candidate topics:
  - Fast ion transport
  - Electron vs. ion thermal: utilize 6 kG
  - Aspect ratio: (intra, inter-machine)
  - H mode threshold, pedestal characteristics
  - Turbulence studies (intra, inter-machine)

Milestones and goals (con't)

HHFW

- FY '02: *Test the effectiveness of using HHFW to drive plasma current via direct interactions with the electrons and/or fast ions to prepare for a quantitative assessment in high-temperature spherical torus plasmas.*
  - Likely requires long pulse, low current in absence of MSE
  - Interaction with ISD group likely
- Possible range of topics
  - Source determination
  - CD assessment in long pulse, low current
  - Fast particle/wave interactions
  - Coupling, phasing studies

Milestones and goals (con't)

Coaxial Helicity Injection

- FY '02: *CHI will be utilized to initiate and noninductively maintain plasma currents up to 400 kA.*
  - *Testing will begin of strategies for controlling CHI plasmas in order to couple them to plasmas sustained by magnetic induction and heated by radio-frequency waves.*
- FY'03: *500 kA, feasibility of coupling to HHFW*
- A control development issue - some effort in ISD group as control work matures: how do we best connect the two efforts?

- Experiments aimed at flux closure physics assessment, absorber arc reduction, biasing effects on confinement
- CHI/HHFW or CHI/ohmic work for handoff: in close contact with ISD group

Milestones and goals (con't)

Boundary physics

- FY 03: *Measure and analyze the dispersion of edge heat flux and assess the impact on plasma facing component requirements under high heating power*
- Need to take a step up in our quantification of edge influxes, heat flux scaling in different regimes
- Also: open field line physics (scrapeoff transport)
- Plasma boronization development also takes place in this ET

- We are planning for 60 total run days
- Guidance:
  - ISD 15%
  - MHD 15%
  - T&T 15%
  - HHFW 15%
  - CHI 10%
  - Boundary physics 10%
  - Cross-cutting/enabling 5%
  - Scientific contingency 15%
- There will be adjustments around the margins
- Identifying what you cannot do in this allotted time is also helpful
- Your feedback on these fractions, in light of the research goals, is welcome

November 2001 NSTX Forum agenda

Wednesday morning, November 28

• 8:30 - 8:35	Welcome	R. Goldston
• 8>35 - 8:40	DoE Perspectives	D. Priester
• 8:40 - 9:00	NSTX research role in a possible next-step	M. Peng
• 9:00 - 9:30	Forum Structure and ‘02 Milestones and Goals	E. Synakowski
• 9:30 - 9:50	Facility update: expected NSTX capabilities	M. Ono
• 9:50 - 10:10	Control System Development	D. Gates
• 10:10 - 10:30	- Break -	
• 10:30 - 10:50	Diagnostic status for ‘02 research	R. Kaita
• 10:50 - 11:05	New capability: edge probe	J. Boedo (offsite)
• 11:05 - 12:05	ET leaders perspectives on ‘02 research	

  – ISD, MHD, Transport, HHFW, CHI, Boundary (10 minutesmaximum each)

- 12:05 - 1:00 LUNCH

After this morning's plenary session, we will have 1.5 days of breakout sessions

Breakouts

- Wednesday 1:00 - 5:30 MHD *LSB Aud.* HHFW *Director's C.R.*
- Thursday 8:30 - 12:30 Transport *LSB Aud.* CHI *B-318*
- Thursday, 1:30 - 5:30 ISD *LSB Aud.* Boundary *B-318*

Also…

- Thursday 5:30 - 6:30 ET leaders, myself, RC: *B-318* discuss rough spots (overlap, gaps…)

Plenary…

- Friday 8:30 - 12:00 Outline of proposed strategy from ETs *LSB Aud.*