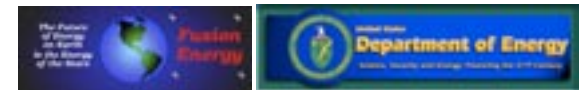


The NSTX Forum Structure, and 2003 Research Milestones and Goals

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NSTX Research Forum
September 11-13, 2002



This Forum is an important step in our program planning

- Now the discussion should be *forward looking*
 - Consider program vision, research milestones, experimental capabilities
- Discussions of research ideas in breakout sessions will be key
- Milestones important
 - But clearly much can be done beyond them
- A chance to identify collaborative research opportunities
- Output of the Forum: outline of a suggested research strategy

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

- Integrated Scenario Development (Maingi, Menard)
- MHD (Sabbagh, Gates)
- Transport and Turbulence (Stutman, Darrow)
- HHFW (Taylor, Ryan)
- CHI (M. Bell, Raman)
- Boundary Physics (Kugel, Kaita)

Our plan should address the milestones

Integrated Scenario Development

- Last year
 - A successful response to the need to focus on longer pulse and high performance, and their simultaneous achievement
 - Presidential milestone on applying non-inductive sustainment techniques
 - Success in long-pulse H mode work ($V_{\text{loop}} \sim 0.1 \text{ V}$)
- ISD-relevant FY '03 Milestones
 - *Explore & characterize ST plasmas with high τ_E and high beta (above no wall limit) for $\Delta t \gg \tau_E$*
 - We can reach deeper (there is a lot of physics in exploration and characterization) and our goals extend beyond these milestones
 - Operational scenario development with active control tools still a program need, even if we've been lucky so far
 - *Measure and analyze the effectiveness of using a combination of noninductive techniques to assist in startup and sustainment of pulse lengths up to 1 s.*

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*
 - Clear that we will claim success here. e.g. Coupling of exp't & theory with RWM work impressive; shape dependence, new areas opening up
- '03 Milestones:
 - *Explore & characterize plasmas with high beta near the no-wall stability limit for $\tau \gg \tau_E$*
 - Success here too, but our science will deepen with local analysis with total plasma pressure, MSE CIF, rotation measurements, etc..
 - *Assess interactions between plasma resonant field responses, correction field, and rotation*
 - Requires assessment with new sensor coils being deployed now; low frequency coils later this run
 - Needed to prepare for an '04 decision on active feedback
- Other research needs include fast MHD
- Opportunities with other institutions: collaborative proposals?

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*
 - Recent progress on CHERS should enable a story to be told with analysis; pleasant success with fluctuation correlation measurements (UCLA)
 - Need sorting out of the L mode scaling experiment
- FY '03: closest milestone is : *Explore and characterize plasmas with high beta near the no-wall limit*
- Other opportunities & needs
 - Is there an experiment that expressly can explore the role of beta?
 - Important opportunity: electron thermal transport & hi k fluctuations
 - HHFW a tool for electron thermal transport problem?
 - Clarifying relation to conventional scalings is critical
 - Are we ready to strike for aspect ratio studies?
 - Inter-device opportunities should be highlighted
- Research with other devices: e.g Getting the ST house in order (confinement & MAST). Aspect ratio & DIII-D

Milestones and goals: *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*
 - *Good progress in this in FY '02*
- Assessment point in '03: extra particle control needs
- What do we need to do to make informed statements about a possible liquid Li module?
- For $\tau_{\text{pulse}} > 3$ s: are we ready to begin characterizing heat fluxes with symmetric DN? Sweeping of strike points?
- Open field line physics (scrapeoff transport)
- Opportunities with other institutions: collaborative proposals?

Milestones and goals: HHFW

FY '02: *Test the effectiveness of using HHFW to drive current via direct interactions with the electrons and/or fast ions to prepare for a quantitative assessment in high-temperature ST plasmas.*

- Lots of hard work to get where we are with the global assessment, but need to improve CD test scenarios (power, pulse length)
- Wave/fast ion work progressing nicely

- FY '03: (1) *Measure and analyze the effectiveness of a combination of noninductive techniques to assist startup and sustainment up to 1 s*

- Despite the fact that it is obviously critical to the ST, it is emerging as being of even higher importance in light of community discussions
- MSE coming on-line

- FY '03 (2) *Characterize EBW emissions in order to estimate requirements for EBW heating and CD*

- Needed if we are to make a sensible decision about pursuing an aggressive EBW program

- Opportunities with other institutions

Milestones: *Coaxial Helicity Injection*

- FY '02: *CHI will be utilized to initiate and noninductively maintain plasma currents up to 400 kA.*
 - *Technical difficulties halted progress on this*
- FY'03: *500 kA, feasibility of coupling to HHFW*
 - In light of HIT-II results, we should reexamine if this is the appropriate measure of success
 - **HIT-II results argue for bringing CHI + ohmic goal into '03:** knowing a solution exists is a real gift for the program, highlighting the value of this collaboration, and emphasizing the need to explore
- Interested in hearing your commentary: should we reassess the priority of flux closure determination?
- If time, please reexamine your long time plans

What are the research opportunities that have considerations beyond an ET's boundaries?

- Across the ETs: is there a critical mass of experiments that would make credible comparative programs with MAST, DIII-D, or elsewhere, on core confinement, H mode transition and pedestals, fast ion thermal transport, wall mode...?
 - Can be powerful programmatically and scientifically
 - ST house has to be in order for us to advance, so interactions with MAST and Pegasus are critical
 - Please discuss these sorts of inter-institution opportunities in your group so that we may consider developing a package to bring forward to other programs
- Astrophysical connections (e.g. reconnection, CHI)

- For this exercise, plan on 21 run weeks: 105 run days
- Guidance:

	Run days
– HHFW/EBW	15
– CHI	15
– ISD	13
– MHD	13
– T&T	13
– Boundary physics	8
– Cross-cutting/enabling	10
– Scientific contingency	18
- There will be adjustments around the margins, but note
 - Non-inductive current drive/sustainment needs require heightened emphasis
 - Cross cutting/enabling will pick up some of the boundary physics enabling work, esp. system commissioning
 - Scientific contingency has been increased
- If you have time, consider your priorities with the possibility of cutting these fractions by one third (14 run weeks) as well as 21 weeks.

We will have 1.5 days of breakout sessions,
followed by a plenary summary on Friday

Breakouts

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

Plenary

- Friday 8:30 - 12:00 Outline of proposed strategy from Ets *Auditorium*