Integrated Scenario Development Task Group Breakout Session Summary

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MHD Stability ET Group - 2001 Experimental Plans Session

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Developing synergism by integrating techniques

- Milestones (FY 9/03)
  - Explore/characterize plasmas with high β, τ_e, long pulse
  - Measure/analyze effectiveness of non-inductive CD to assist in start up and pulse length extension (up to 1s)
  - Merge successful techniques of independent XPs of the past into single, superior unit
- Supporting hardware enhancements
  - Error field reduction (is critical !)
    - Called for by a large number of XPs (both in and outside the ISD ET)
  - High temperature bakeout
  - High field side gas puff
    - Expected to ease H-mode access (following MAST experience)
  - Improved plasma control system
    - Important for most experiments, especially CHI

Ideas for high β, high τ_E, and/or long pulse

- Low field vs. high field side fueled H-modes (Maingi)
  - Compare H-modes at B_t = 0.45 T
- Combined ITB and H-mode (Bush)
  - Higher τ_E and β – analogy to QDB regime in DIII-D
  - Development of target plasma for other XPs to use
  - Approach
    - Operate well conditioned machine and inner gas puff
    - Suggested scan of B_t , I_p, and different plasma configurations
- Dependence of resistive wall stabilization on equilibrium (Paoletti)
  - Operate at increased β and β_N (β_N up to 10 l_i)
  - Determine dependence of no-wall / with-wall β limit on equilibrium
  - Use H-mode, HHFW for profile control; vary boundary; vary B_t

OH solenoid-free CD and pulse extension Ideas (i)

- Solenoid-free inductive startup (Menard)
  - Use external PF coils only + ICRF
  - Prototype concept on GLOBUS-M (perhaps in CY 2002)
  - No plan to attempt this in NSTX in CY 2002
- XP 25: Early HHFW Heating (Menard)
  - Previous success in broadening P_e, clamped $l_i \sim 0.5$
  - Early FW heating shots have slow rotation – mode locking
  - Goals
    - Understand effect of HHFW on toroidal rotation from NBI
    - Study effect of ramp-rate and
    - Long pulse high q(0) HHFW as NBI target, then ramp I_p

OH solenoid-free CD and pulse extension Ideas (ii)

- Coupling HHFW plasmas to NBI plasmas (LeBlanc)
  - Spend ~ ½ day to find best conditions to couple HHFW to NBI
  - Comment that this should be performed in the RF ETG
- Long pulse using HHFW H-mode plasma (Wilson)
  - Present Ip = 0.37 MA HHFW plasmas (40% bootstrap current)
  - Li saturates and drops, q(0) increases – t_{pulse} ~ 0.34 s
  - Broad T_e, n_e profiles; high poloidal beta ~ 1
  - SCOPE: approach t_{pulse} = 1s; no B_t variation, and no NBI

Supporting discussion for scenario integration

- Control system development
  - rtEFIT (Ferron)
    - Boundary shape and error evaluation in real time
    - Isoflux control test might need a few days dedicated time
  - Profile control: real time calculations vs. using simple rules
    - May only need simple constraints (i.e. q(0) > 1)
  - Neural network? Real time stability?
- Analysis
  - TSC available to model integrated, long pulse scenarios
  - NSTX/Globus database browsing tool for PC (A. Detch)
- Feedback support for long pulse
  - Density control (on gas), beta feedback (on heating)
  - Changing NBI modulation as a function of time

ISD experimental run schedule for CY 2002

- Constraints
  - Six experimental task groups
  - ISD ET slated to have 9 run days
- Experimental proposals
  - 6 XPs presented
- NEED for a high β NBI/HHFW experiment
  - Replace NBI heating with RF heating at high β, for example

NSTX ISD Task Force proposed XPs (9 days total)

Experimental Proposal	(run days suggested)	Leader
H-modes fueled from low and high field side	(1)	R. Maingi
Combined H-mode / ITB scenario development	(1)	C. Bush
HHFW heating during current ramp-up	(1)	J. Menard
Long pulse with HHFW current drive phasing	(1)	R. Wilson
Dependence of resistive wall stabilization on equilibrium	(1)	F. Paoletti
Improved RF coupling with NBI	(0)	B. LeBlanc
rtEFIT isoflux control development (XMP)	(?)	J. Ferron
Long pulse, high β XP with NBI and HHFW	(1)	Not explicit
Contingency time for ISD experiments	(3)	

(FR): Pending formal review (##): In progress (C): Completed