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WPI TSG Research Planning for FY11-12 NSTX Run Campaign

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WPI TSG Meeting

B252

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Most NSTX experiments will need to support FY11-12 research milestones and/or ITPA

- Only 10 weeks of plasma operation in FY11 to support 4 NSTX research milestones and the joint research milestone
- Depending on FY12 budget, 10 weeks of plasma operation in FY12 to support 3 NSTX research milestones and the joint research milestone
- Look to "piggyback" on milestone/ITPA-relevant experiments if possible
- NSTX Research Forum will be held March 15-18
 - Forum Web site is located here: <http://nstx-forum-2011.pppl.gov/waves.html>
- WPI TSG meeting at the Forum is on March 17, 9 AM-12 noon in B233:
 - ~ 2 hours XP presentations (5-10 min each) + ~ 1 hour for prioritizing XPs
 - SFSU TSG XPs using HHFW will be discussed 12 noon – 1 PM in B252
- Goal of this meeting is to identify, ahead of the Forum, which XPs contribute to high priority WPI TSFG research and/or ITPA:
 - which lower priority XP's might be "piggybacked"

WPI TSG research priorities & ITPA participation

Research Priorities:

- Utilize HHFW heating and current drive to assist non-inductive plasma current ramp-up and sustainment (R12-2) [with SFSU TSG]
- Characterize and optimize high-harmonic fast wave coupling in deuterium H-mode plasmas
- Assess predictive capability of mode-induced fast-ion transport (IR12-2)
- Extend TAE/EPM studies to H-mode plasma

ITPA Participation:

- TC-9 Scaling of intrinsic plasma rotation with no external momentum input
- TC-14 RF rotation drive
- IOS-5.2 Maintaining ICRH coupling in expected ITER regime
- EP-2 Fast-ion loss and redistribution from localized Alfvén eigenmodes
- EP-4 Effect of dynamical friction (drag) at resonance on nonlinear Alfvén eigenmode evolution
- EP-6 Fast ion losses and associated heat load from edge perturbations (ELMs and RMPs)

High priority HHFW XPs/XMPs for FY11-12 campaign

Establish Maximum HHFW Arc-Free P_{RF} Early in Campaign:

- Assess "clean" double-fed antenna performance in plasma early in campaign with minimal Li deposition, or no Li with boronization:
 - Need to know maximum arc-free P_{RF} early to develop run plan strategy

1st Priority:

- HHFW coupling at low I_p & during I_p ramp-up (with SFSU TSG): **R(12-2)**
 - HHFW heating of low I_p plasma to obtain H-mode with $f_{NI} \geq 100\%$
 - Assess HHFW ramp-up of inductively generated discharge from 250 to 400kA
 - Couple HHFW into CHI-initiated plasma

2nd Priority:

- Prepare for NSTX-U running HHFW+NBI high I_p H-modes at $P_{nbi} \sim 6$ MW:
 - Understand interaction of RF with fast ions from NBI
 - Interaction of fast-ions with antenna and antenna heating
 - Surface wave studies at maximum available P_{rf} & P_{nbi}
 - Dependence of heating and CD efficiency on $k_{||}$, outer gap, n_{edge}

High priority EP XPs for FY11-12 campaign

Extend code validation to H-mode scenarios,

Complete benchmarking of codes for high-frequency *AEs (GAEs/CAEs)

1st Priority:

- Establish a good H-mode target to study TAEs/EPs and their effect on fast ion transport:
 - Revisit *AE effects on NB-driven current profile (ASC-TSG)
- Characterize high-f *AEs:
 - Mode structure, coupling to low-frequency modes (avalanches)
- Assess predictive capability of mode-induced fast ion transport: IR(12-2)
 - Benchmark codes: HYM, M3D-K and SPIRAL; model GAE/CAE and TAE dynamics

2nd Priority:

- Support heating, ramp-up of CHI start-up plasmas (SFSU-TSG) R(12-2)

XMP:

- Commission new tangential FIDA systems

Status of 1st priority WPI TSG experiments in 2010

- XP1009** HHFW-heating of low I_p plasmas (Taylor) **started (with SFSU TSG)**
- XP1010** $f_{NI}=100\%$ low I_p HHFW H-modes (Taylor) **not started (with SFSU TSG)**
- XP1011** P_{NBI} scaling for H-mode TAE avalanche threshold & GAE avalanche studies (E. Fredrickson) **started**
- XP1012** Heating efficiency of HHFW in NBI target plasmas & HHFW acceleration of fast ions (LeBlanc, Podesta, Heidbrink) **not started**
- XP1013** *AE-induced electron transport (Tritz) **completed (with T&T TSG)**
- XP1014** Angelfish instability & effect of HHFW (Heidbrink, Fredrickson) **not completed**
- XP1015** Validation of M3D-K for NBI TAEs (Fu, Podesta, Crocker, Smith) **completed**
- XP1016** Study HHFW power coupling versus ELM activity (Hosea) **not started**
- XP1017** HHFW heating at the divertor SOL regions (Hosea) **started**

Agenda

- ✧ WPI TSG Planning for FY11-12 – Gary Taylor
- ✧ Low I_p HHFW Heating & Current Drive Experiments - Gary Taylor
- ✧ HHFW Power Coupling vs ELMs - Joel Hosea
- ✧ RF Heating at Divertor/SOL Regions - Joel Hosea
- ✧ Turbulence Characteristics for HHFW H-Mode - Joel Hosea
- ✧ Using HHFW to Increase f_{NI} in NBI H-Modes with ELM Impurity Control - Michael Bell
- ✧ Characterization of Fast Ion Acceleration in RF-Heated Plasmas - Mario Podesta
- ✧ Effect of Toroidal Rotation on TAEs - Mario Podesta
- ✧ Investigation of an 'Anomalous' High-Energy Feature - Sid Medley
- ✧ Exploiting t-FIDA v-FIDA Comparisons - Bill Heidbrink
- ✧ TAE Phase Variation & Reflectometer – Neal Crocker
- ✧ Tangential FIDA Commissioning XMP - Alessandro Bortolon
- ✧ Effect of TAE/EPM on NBI Current Drive Efficiency - Alessandro Bortolon
- ✧ Effect of Low Frequency MHD on Fast Ion Confinement - Alessandro Bortolon
- ✧ Effect of Induced 3D Fields on Fast Ion Confinement - Alessandro Bortolon