

Waves & Particles FY09-13 Research Opportunities



HHFW Research

- Modify HHFW antenna to double-end fed configuration to reduce voltage for same power and provide increased power capability
- Redesign antenna array to provide higher k_{\parallel} spectral peaks for improved coupling for HHFW CD and for heating of low T_e start-up plasmas:
 - *we will change the antenna configuration if expt. & theory support it*
 - *this is second priority to modifying feeds for more power to support start-up & CD*

ECH/EBW Research

- ECH/EBW experiments with CHI & PF-only start-up at 100-200 kW (using one 28/15.3 GHz ORNL gyrotron in FY09)
- Test B-X-O coupling & electron heating at 200-400 kW (400kW using two 28/15.3 GHz ORNL gyrotrons in FY10):
 - *Use B-X-O oblique mirror launcher*
- EBW-HHFW synergy experiments (maybe weak, needs modeling)

Waves & Particles FY09-13 Research Opportunities (cont.)



Energetic Particle Research

- Multi-mode driven Energetic Particle (EP) effects:
 - *mode amplitude saturation*
 - *transport of EP, modification of distribution function*
 - *effects on current drive (similarity with DIII-D)*
 - *interplay with different modes (fishbones, EPs, NTMs...)*
- Phase space engineering through high frequency mode physics:
 - *CAE/GAEs below ω_{ci} likely to couple to HHFW antenna*
 - *Energy channeling: HHFW antenna may pump mode amplitude to stochastic damping threshold wave energy should then mostly flow to thermal ions*
 - **AE chirping effects to study velocity (phase space) diffusion*
 - *Study higher cyclotron harmonics of CAEs*
- Address unique NSTX physics:
 - *High β study of two fundamental MHD branch interactions: Alfvén & acoustic*
 - *MHD spectroscopy at high β via RSAEs (cascades), Alfvén-acoustic modes*
 - *Bounce frequency fishbones*
 - *NTM interaction with EP (high β , low aspect ratio) and current drive effects*