Research Interests for 2006 in Transport & Turbulence

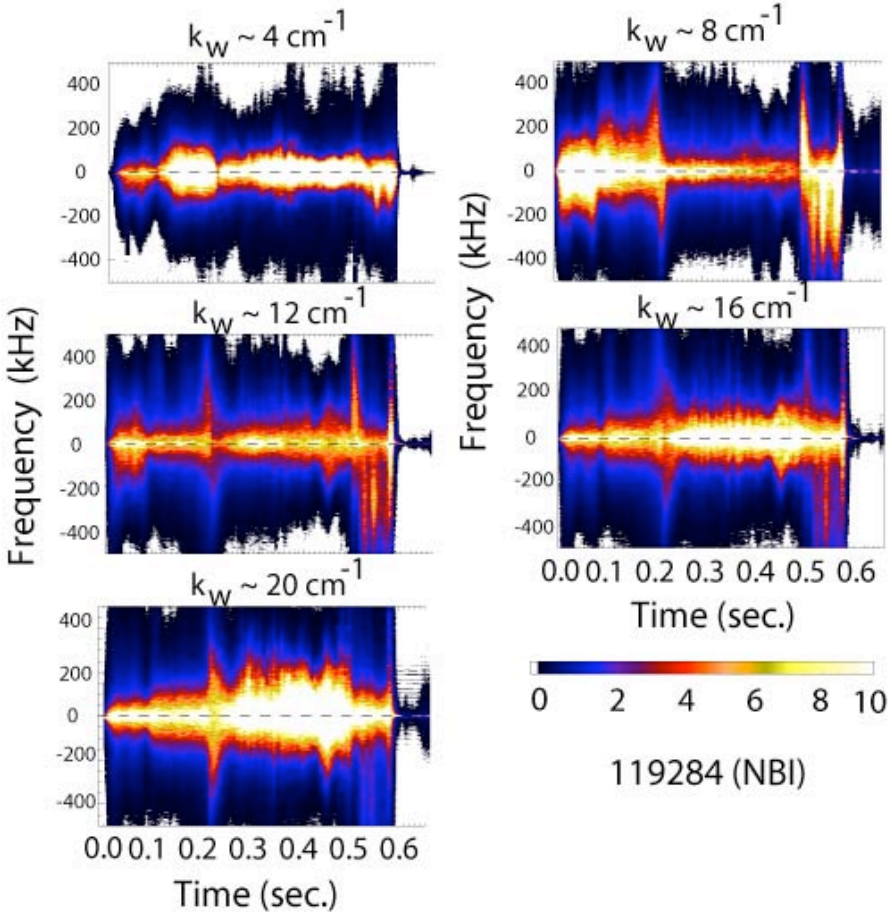
- **Turbulence measurements with high-k μ-wave scattering**
  - ***Milestone R(06-1)****: Measure short wavelength turbulence in the plasma core in a range of plasma conditions. (September 2006)*
- Study of RS discharges with & without eITBs
  - L- and H- mode shots
- Perturbative studies of electron transport
- Effects on transport of reducing recycling by lithium coating
- Scaling of confinement, particularly β & B, A dependence
  - ITPA: CDB-2 (β), CDB-6 (A), CDB-8 (ρ*), CDB-9 (low n_e, $T_e \approx T_i$)
  - Also scaling studies for NSTX-U

Progress in High-k Scattering Experiments

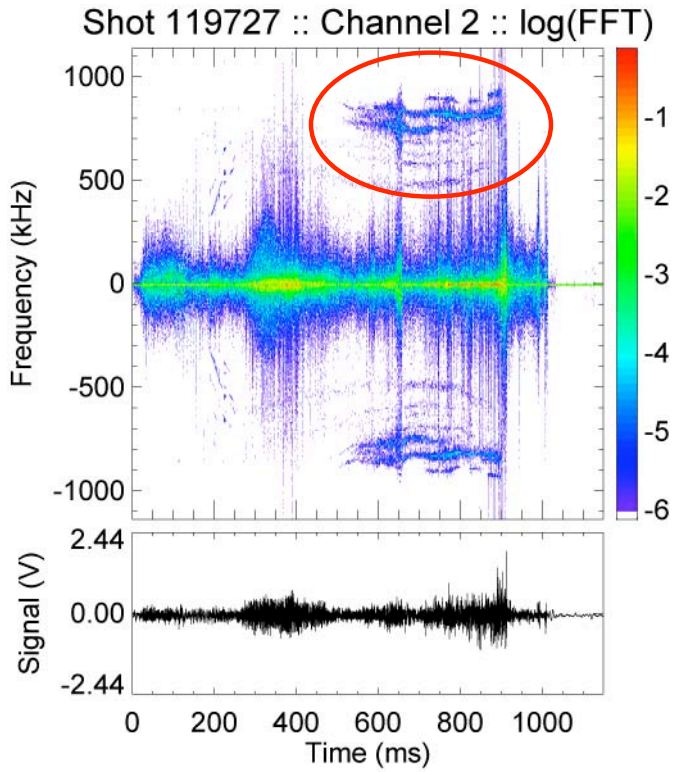
- Commission and evaluate diagnostic in XMP-44
  - Lost some time early in run to technical problems
  - ~35 dedicated shots on 3/20-21 plus periods of controlled access during other experiments
  - Still some issues surrounding adequacy of beam alignment
- Measuring changes in signals related to phenomena known to cause or change density fluctuations
  - Data presented this week at HTPD Conference
- Now need to develop dedicated XP in optimal conditions
  - Low-density, reverse-shear shots which develop eITBs
  - H-mode transitions
- Producing quantitative fluctuation data will require extensive calibration and analysis post-run

Results from High-k Scattering

- Fluctuations decrease at H-mode
- Outboard launch ρ ≈ 0.95



- Fluctuations from CAE/GAE
  - Well correlated with Mirnov data
- Inboard launch ρ ≈ 0.04
- $k_\perp \rho_e$ = 0.3-0.15

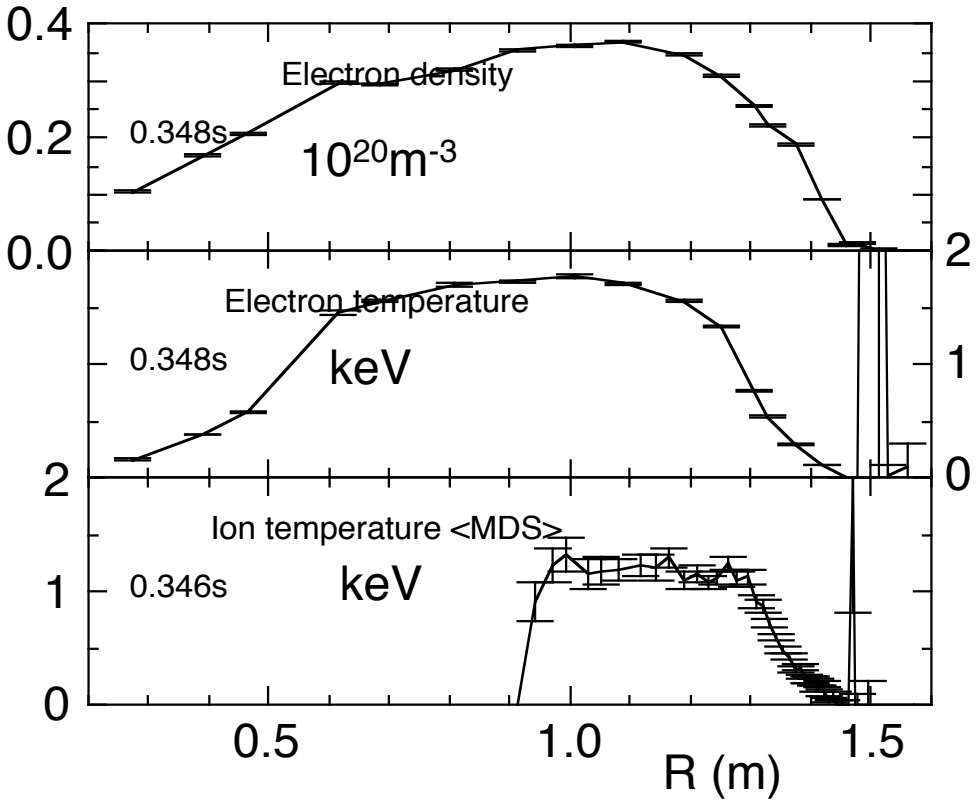


Injection and Penetration of Li-doped TESPEL

- XMP-47 (Stutman *et al.*) completed on 3/24 (7 shots) during visit of collaborator N. Tamura (NIFS)
- Inject small (few hundred μm) shells of deuterated polystyrene filled with LiH tracer (few x10^{18} LiH) using LPI
- Observe penetration with Li telescope, Li-filtered optical detectors, USXR
- TESPEL penetrated ~5cm in L-mode with NBI
  - Density perturbation few %
- TESPEL did not penetrate scrape off in 6MW H-mode
- TESPEL produced small density near edge inside LCFS in 4MW H-mode
- TESPEL penetrated deeply insode and demolished a 2MW H-mode
- Utilized remaining TESPELs in XP-612 on 5/3

Completed First Phase of RS Experiment

- **XP-610** (Levinton, Yuh) run on 3/27–28 (33 shots, 10.6hr)
  - FCPC (2hr), "acq" errors (8), diagnostics (1hr), MG trip (30min)
- I_p = 0.8 – 1.0 MA, B_T = 0.45 T, P_{NBI} = 2 MW



- Adjusted growth phase, NB timing to vary q(r,t)
  - some success but performance quite variable
- Reproduced $T_e(0)$ = 2.0 keV with apparent RS
- Data now being analyzed
- Phase 2 (B_T = 0.5, 0.55 T) and Phase 3 (RS H-mode) remain to be explored
  - Estimate 2 days of runtime

Investigated Perturbed Electron Transport in H-mode

- **XP-612** (Stutman *et al.*) run on 5/3 (20 shots, 6.9hr)
  - FCPC 3 shots, PCS 5 shots lost
- Inject small Li pellet or Li-doped TESPEL into 1.0MA, 0.45T, H-mode heated with 2 – 6 MW NBI
  - L-mode not investigated yet
- Followed evolution of T_e perturbation with USXR, OSXR, Li telescope
  - LPI worked well
  - Observed expected increase in speed of propagation with heating power, *but*
  - Perturbation was smaller than in prior years
  - On one shot pellet triggered transition to lasting improved confinement
- Desirable to reproduce some shots with larger perturbations from C pellets
  - Requested LPI team to load suitable pellets for next period of operation
  - Estimate 2 hours operation to document shots
- L-mode phase of experiment needs additional 4 hours *if previous (2005) discharges are reproducible*

Experiments Planned or Under Consideration for Remaining 2006 Runtime

1. Z-scaling of impurity transport in NB heated H-mode discharges (L.F. Delgado-Aparicio, JHU - thesis work)
   - OSXR array now operational
   - Use C pellets and/or CD_4 puffing to introduce C and follow evolution
   - XP to be reviewed by ET Group next week
2. B_T and β scaling of confinement: XP-532 (Kaye)
   - Provide NSTX contributions to ITPA tasks CDB-2 (β), CDB-8 (ρ^*)
   - Approved in 2005 but thwarted by TF restriction
   - Needs 0.5, preferably 0.55 T toroidal field: now ready
3. Dedicated XP for High-k Scattering (Smith *et al.* - thesis work)
   - XP to be developed: use existing scenarios as much as possible
4. Scaling study for possible upgrades to NSTX (Bell *et al.*)
   - NSTX-U now a higher priority?
   - Scans constrained by dependences in systems code studies
   - XP to be developed: new scenarios will challenge control system