

# Edge Turbulence Imaging During L-H Transitions in NSTX

S.J. Zweben, R.J. Maqueda, T. Munsat, D. P. Stotler,  
T.M. Biewer, C.E. Bush, B. LeBlanc, R. Maingi,  
N. A. Crocker, W. A. Peebles, S. Kubota, X. V. Nguyen  
and the NSTX Team

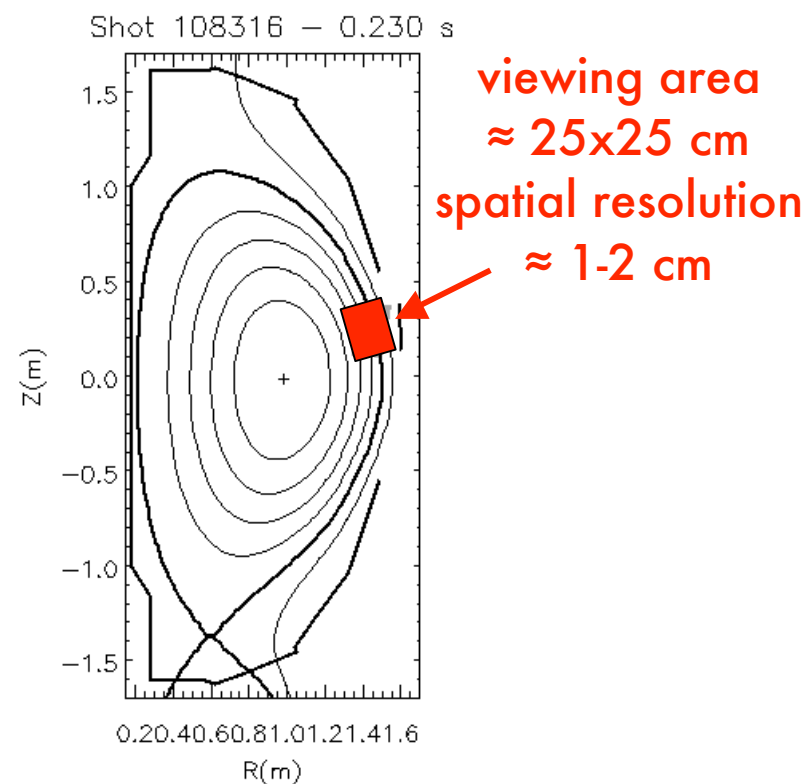
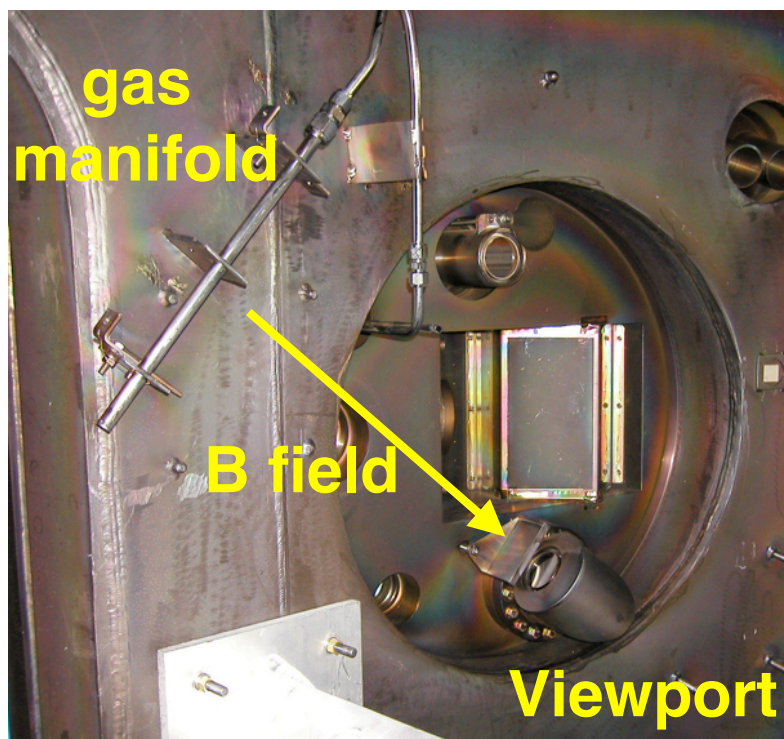
Question: Does edge turbulence during L-H transition  
show poloidal shear-induced decorrelation ?

APS '04 - CO3.011



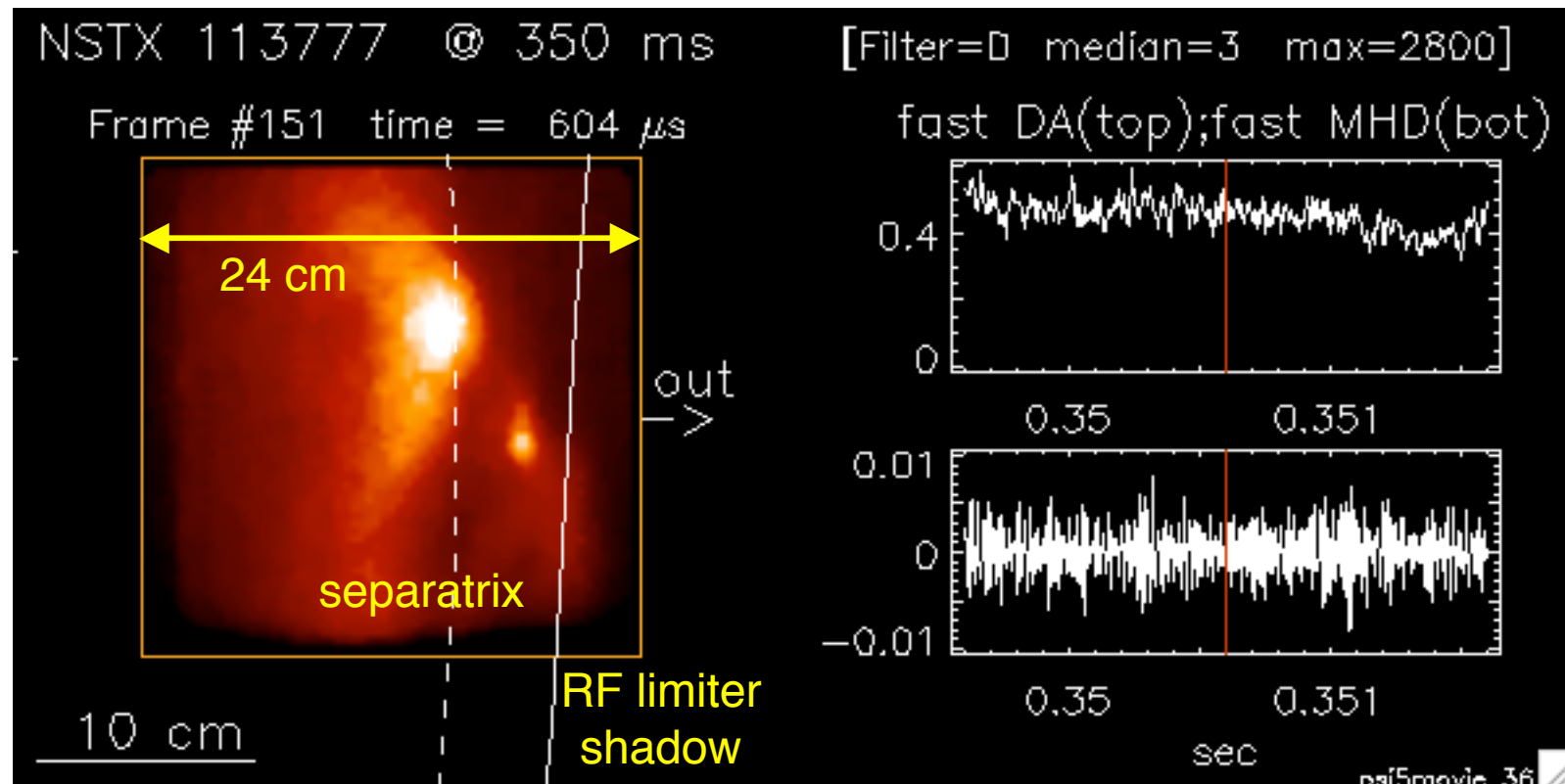
# GPI Diagnostic in NSTX

- Views  $D_\alpha$  (or HeI) light from gas puff  $I \propto n_o n_e f(n_e, T_e)$
- Sees  $D_\alpha$  fluctuations only in range  $\sim 5 \text{ eV} < T_e < 50 \text{ eV}$
- View aligned along B field line to see 2-D structure  $\perp B$



# Images of GPI Data

- Using 300-frame PSI-5 camera at 250,000 frames/sec
- Total time of movie =  $300 \times 4 \mu\text{sec} = 1.2 \text{ msec} / 30 \text{ sec}$



see: [http://www.pppl.gov/~szweben/NSTX04/NSTX\\_04.html](http://www.pppl.gov/~szweben/NSTX04/NSTX_04.html)

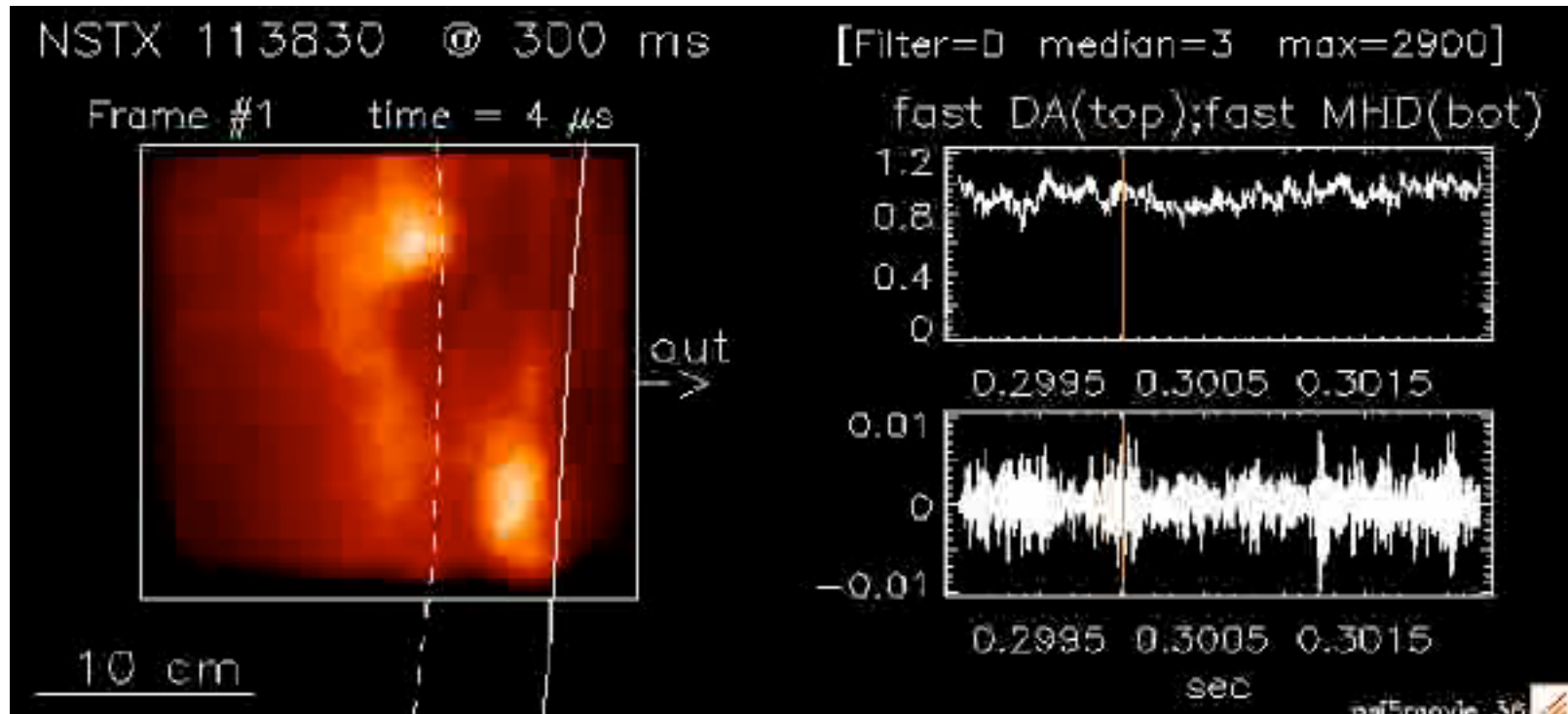
# L-Mode Case

**B=3.0 kG**

**P=2.7 MW NBI**

**I=650 kA**

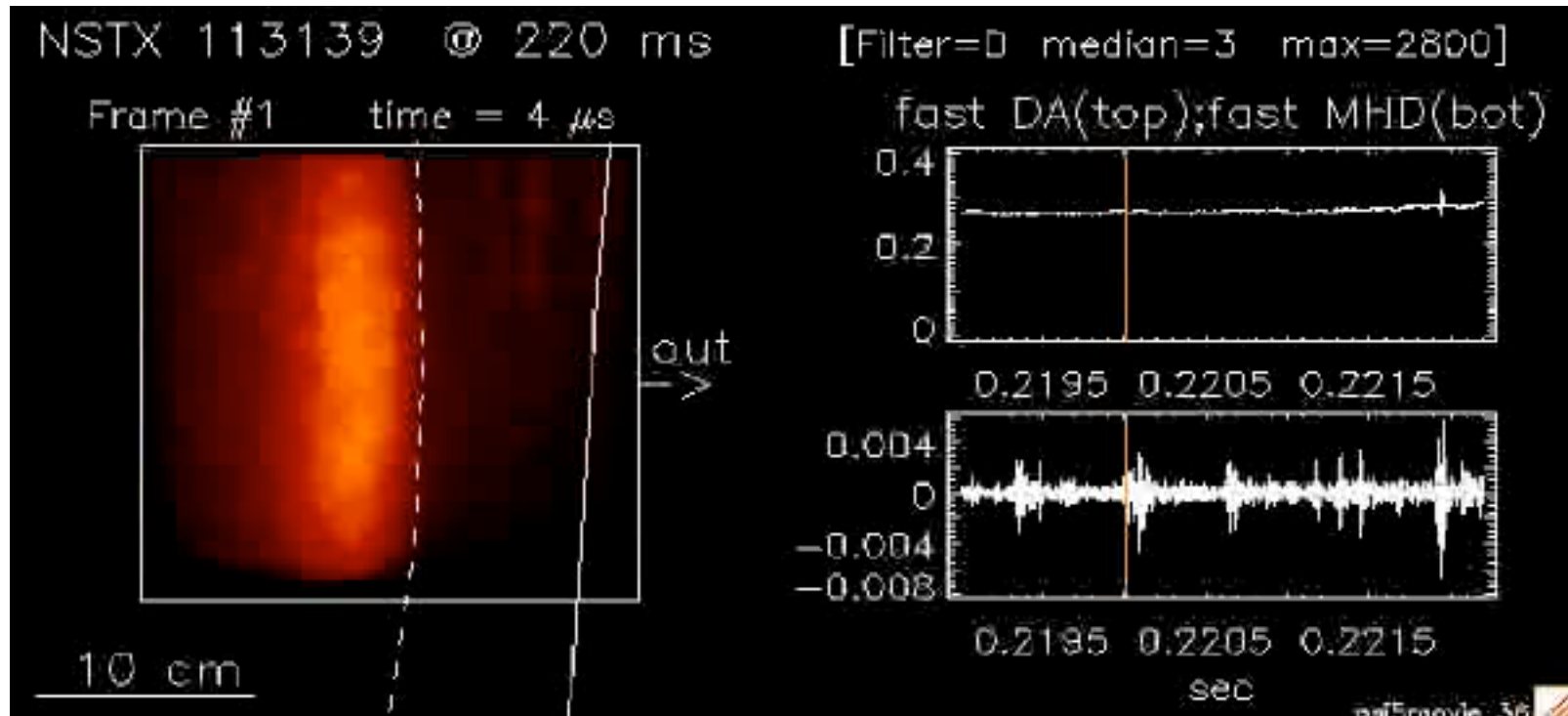
**$\langle n \rangle = 3.3 \times 10^{13} \text{ cm}^{-3}$**



# H-Mode Case

**B=4.5 kG**      **P=0.9 MW NBI**

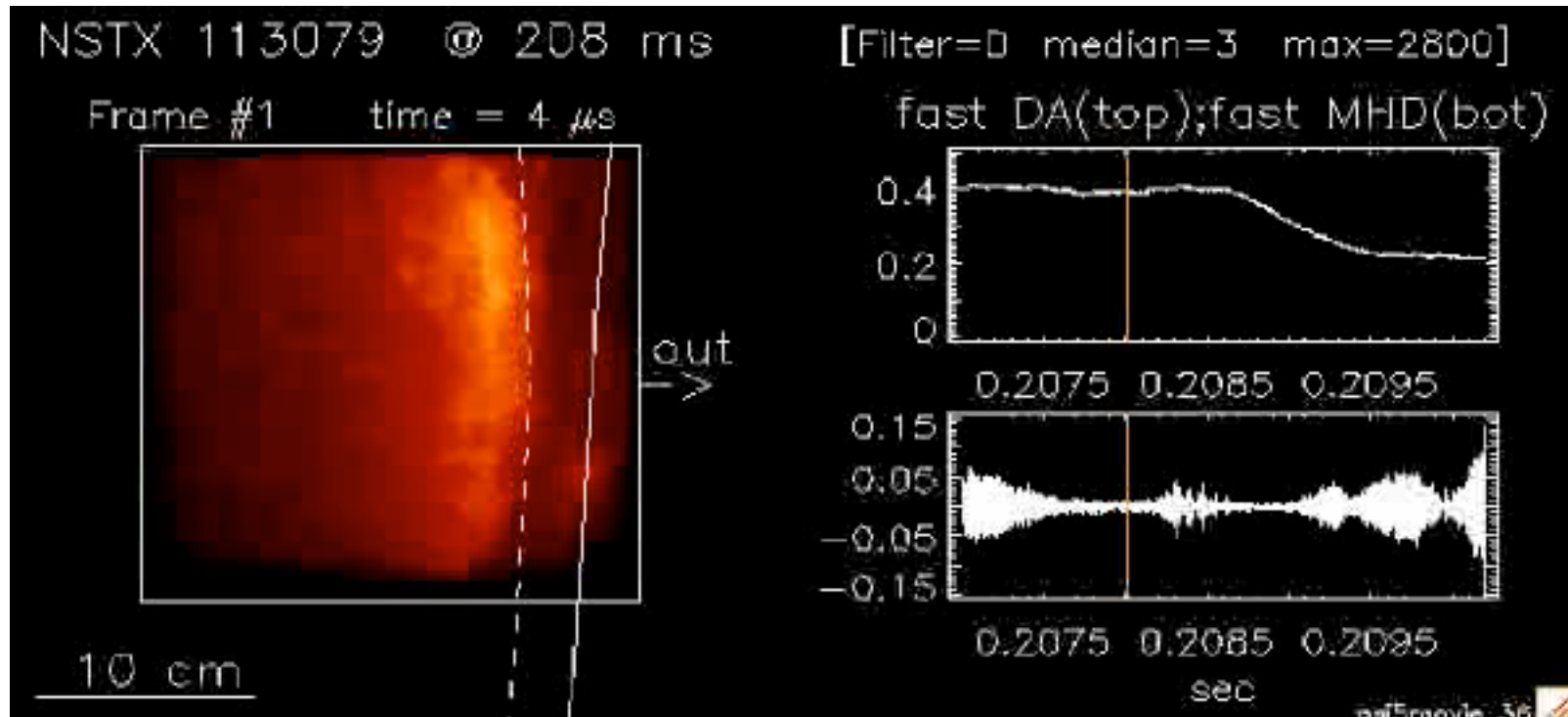
**I=825 kA**       **$\langle n \rangle = 1.9 \times 10^{13} \text{ cm}^{-3}$**



# L-H Transition Case #1

**B=4.4 kG**      **P=2.8 MW NBI**

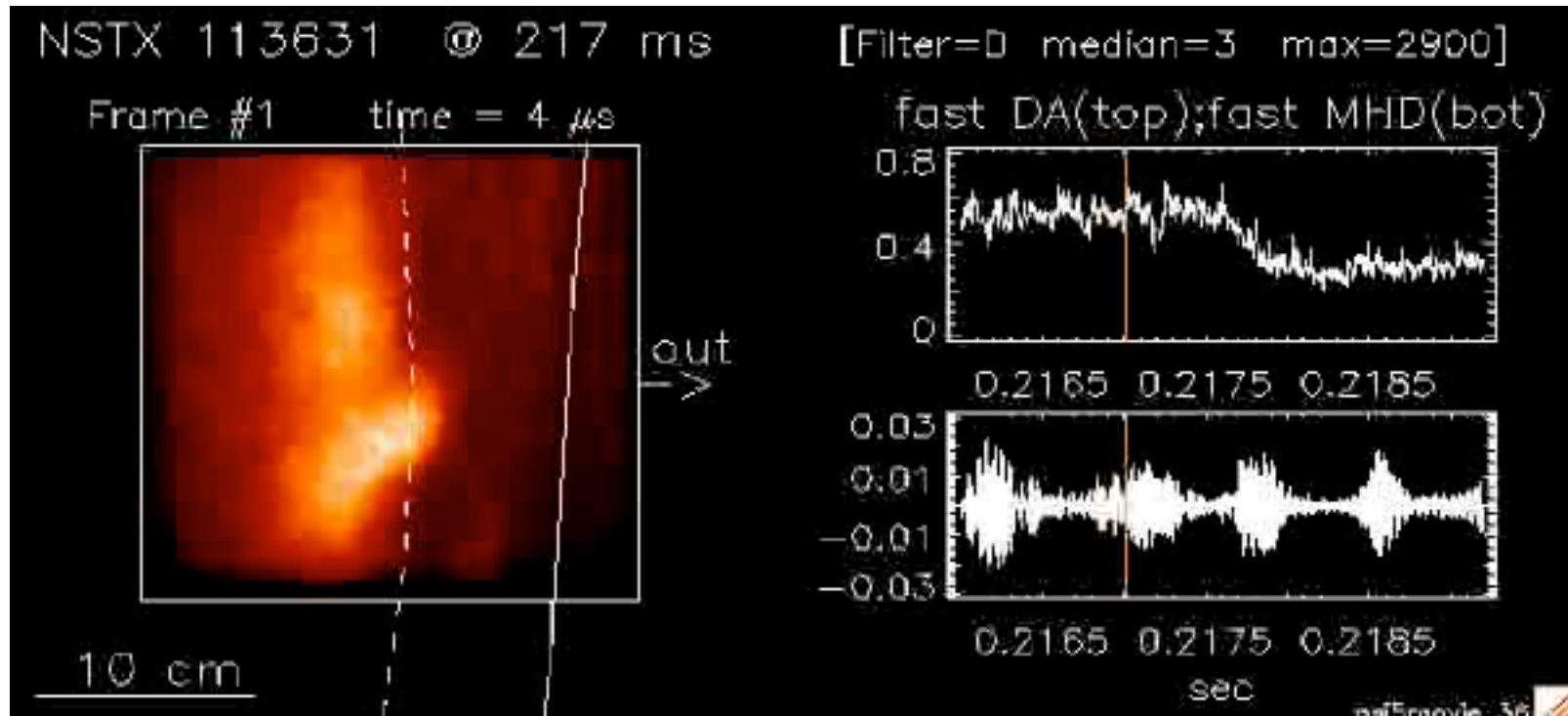
**I=800 kA**       **$\langle n \rangle = 1.9 \times 10^{13} \text{ cm}^{-3}$**



# L-H Transition Case #2

**B=3.0 kG**      **P=2.0 MW NBI**

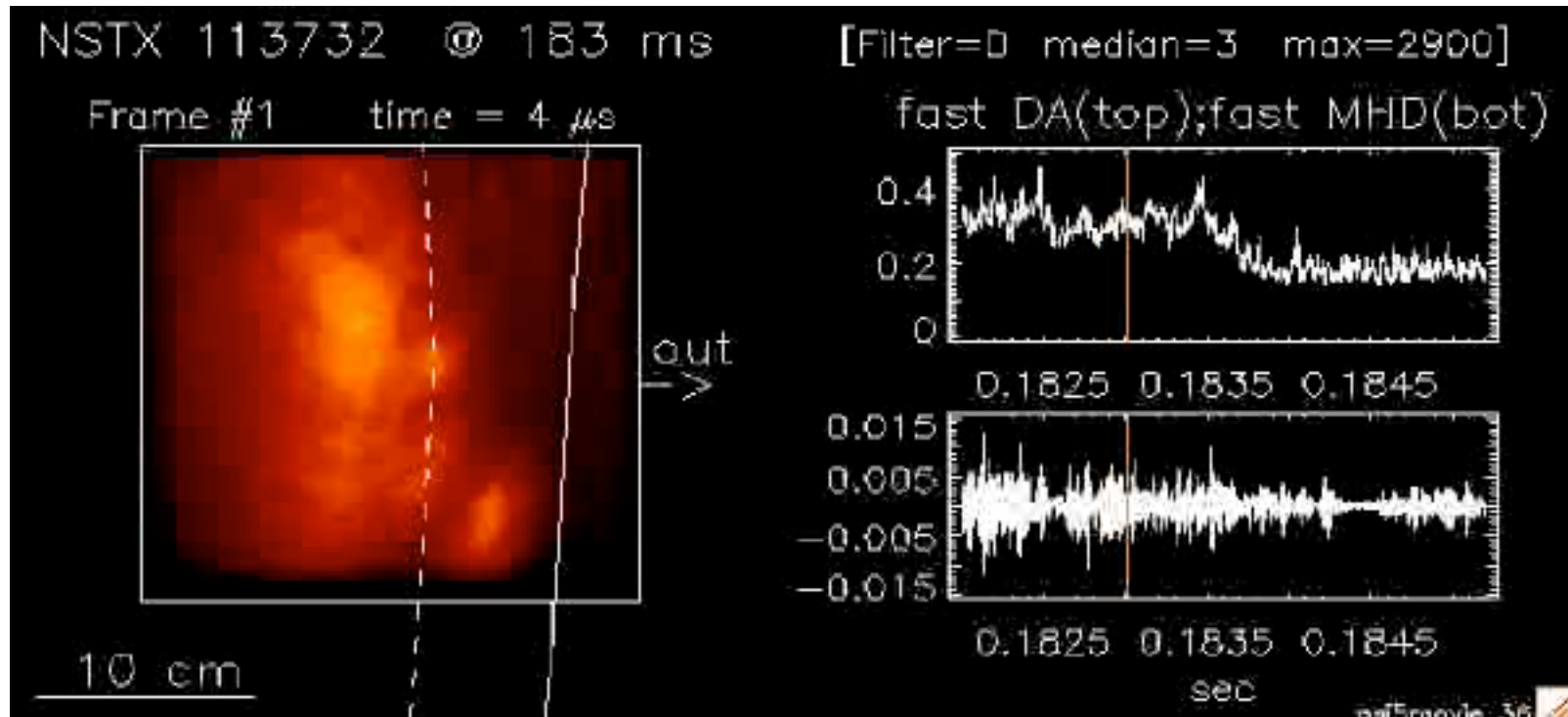
**I=970 kA**       **$\langle n \rangle = 2.7 \times 10^{13} \text{ cm}^{-3}$**



# L-H Transition Case # 3

**B=3.0 kG**      **P=2.0 MW NBI**

**I=780 kA**       **$\langle n \rangle = 2.2 \times 10^{13} \text{ cm}^{-3}$**

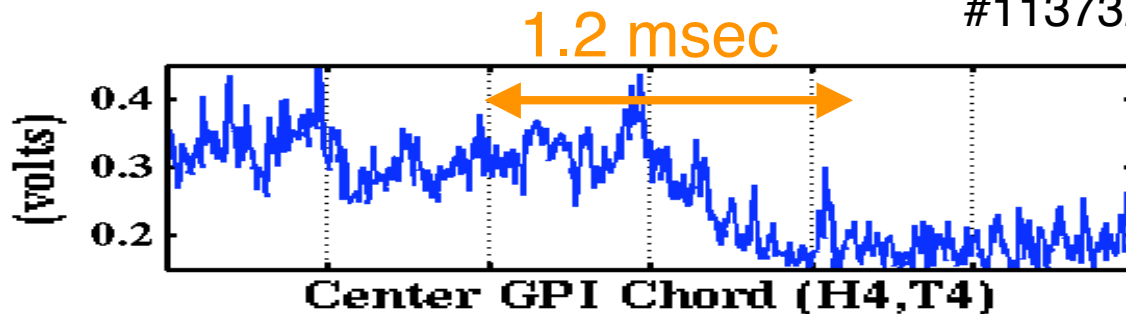




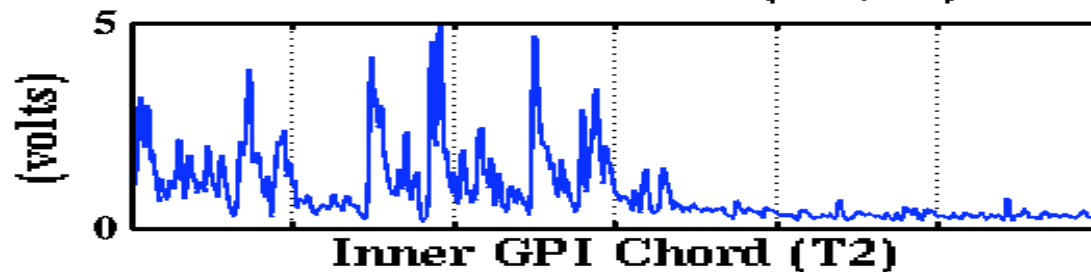
# Time Dependences Near Transition

#113732

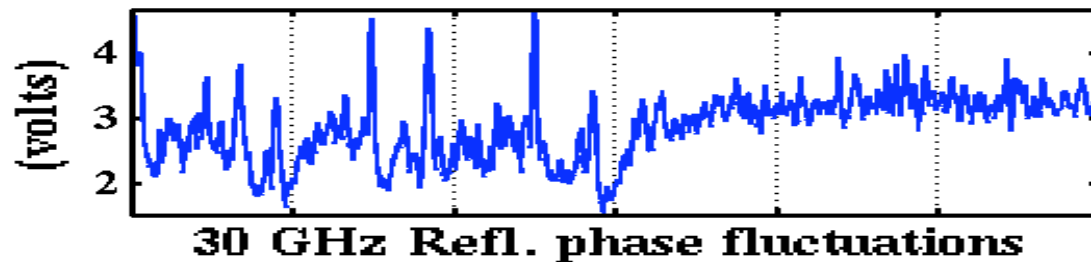
Fast  $D_{\alpha}$  in  
divertor



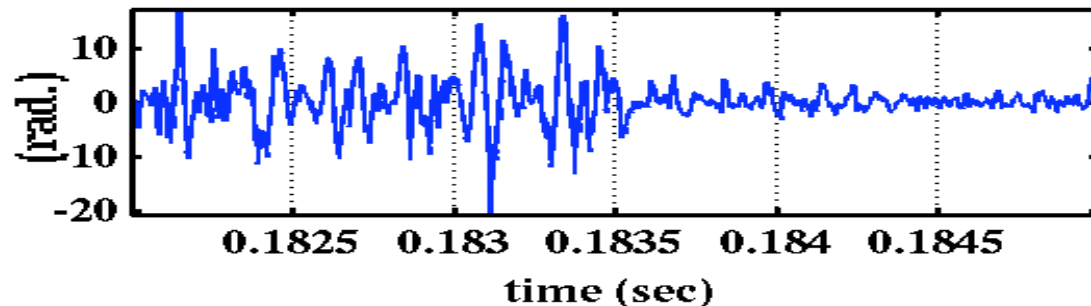
Central GPI chord



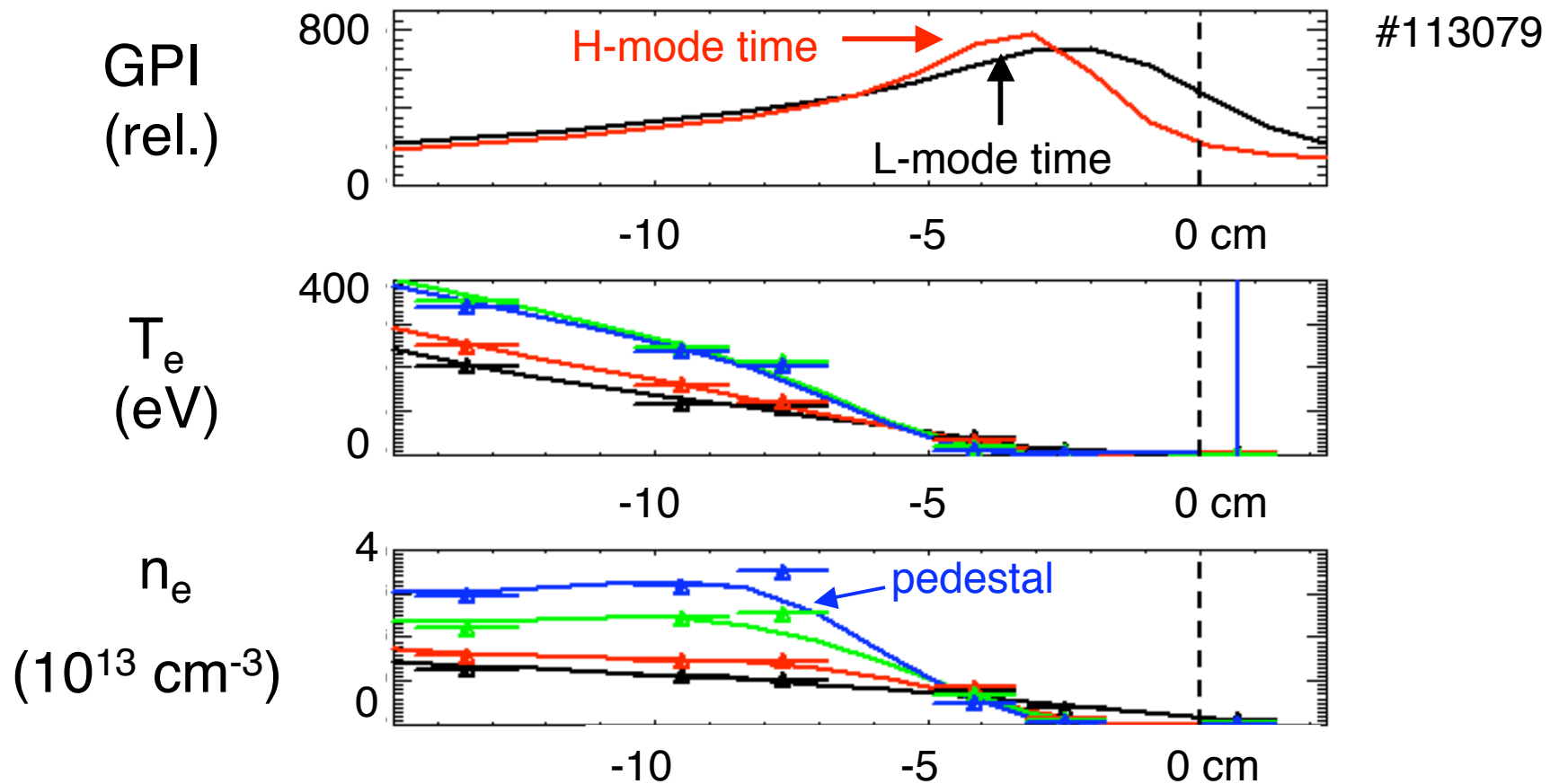
Inner GPI chord



30 GHz reflectometer  
(see Crocker JP1.022)



# Radial Profiles Near Transition



- GPI L-mode signal peaks at  $T_e \approx 11 \text{ eV}$ ,  $n_e \approx 3.6 \times 10^{12} \text{ cm}^{-3}$
- GPI H-mode signal peaks at  $T_e \approx 32 \text{ eV}$ ,  $n_e \approx 8.6 \times 10^{12} \text{ cm}^{-3}$

# Tentative Interpretation

- Transitions from L- to H-mode seem to occur without much change in the 2-D turbulence structure or the poloidal flow(quantitative analysis is in progress)
- This looks different from the usual L-H scenario, which is based on poloidal shearing of edge turbulence
- Assuming this is correct, possible explanations include:
  - **transition dynamics are located farther in radially or elsewhere poloidally (e.g. near X-point)**
  - **transition dynamics occur over longer or shorter timescales than are visible here**
  - **transition is not caused by poloidal shearing**

## Related contributions:

### Monday afternoon:

Edge turbulence - Grulke (CI2A.001 invited talk)

NSTX edge probes - Boedo et al (CO3.010 talk)

C-Mod edge turbulence - Veto et al (CP1.007 poster)

### Wednesday afternoon (NSTX posters):

edge GPI - Maqueda et al (JP1.024)

edge reflectometry - Crocker et al (JP1.022)

edge fluctuations - Lee et al (JP1.023)

divertor imaging - Roquemore (JP1.025)

edge physics - Bush et al (JP1.026)

### Wednesday afternoon (C-MOd orals):

C-Mod GPI - Terry et al (JO3.008 talk)