Ultra-high Speed Imaging of Edge Turbulence in NSTX

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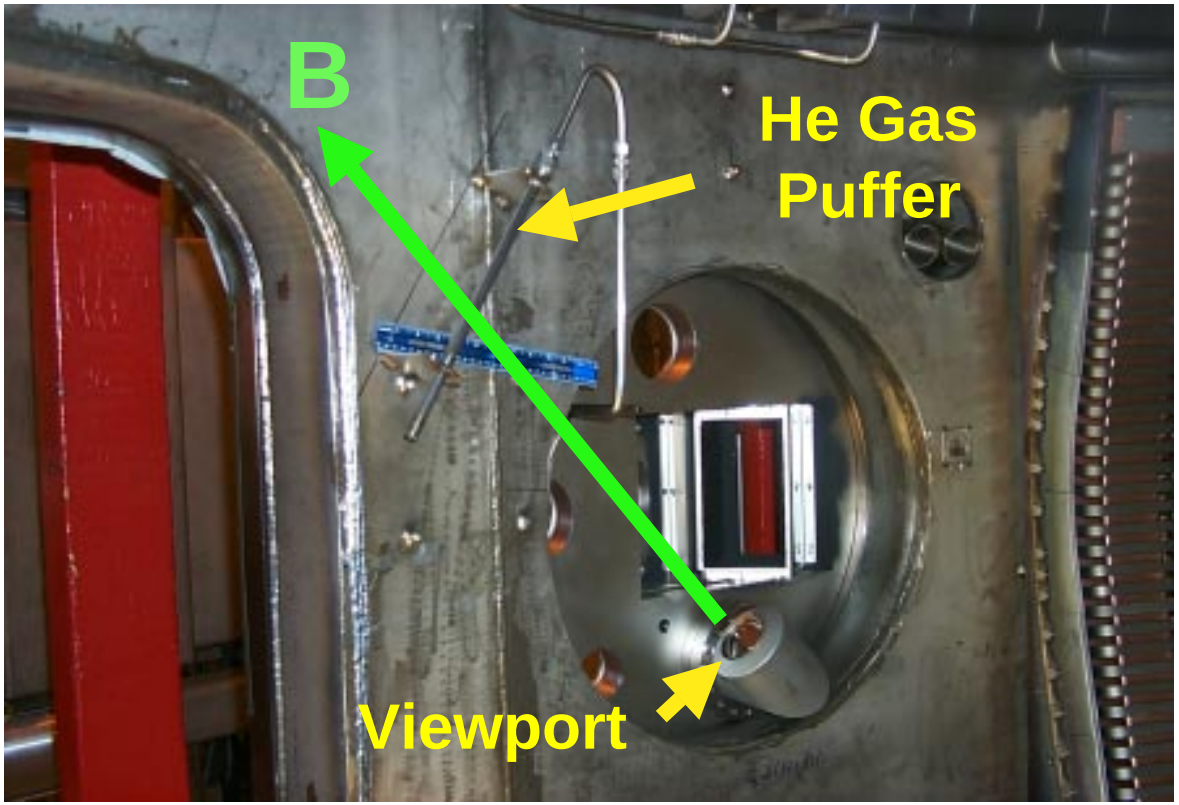
- **Diagnostic**
- **Videos (~ 2 mins)**
- **Image analysis**

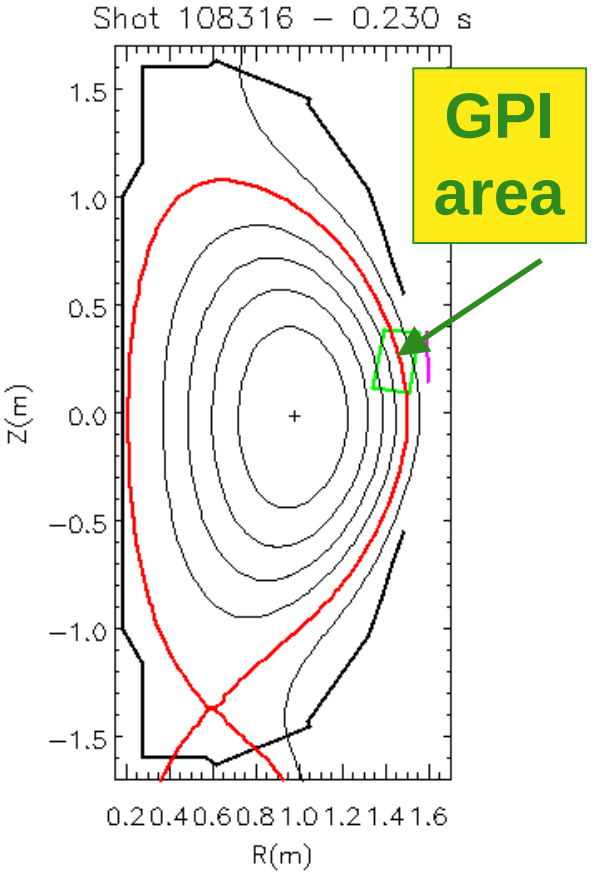
CO1.008
APS '02

NSTX

Gas Puff Imaging Diagnostic in NSTX

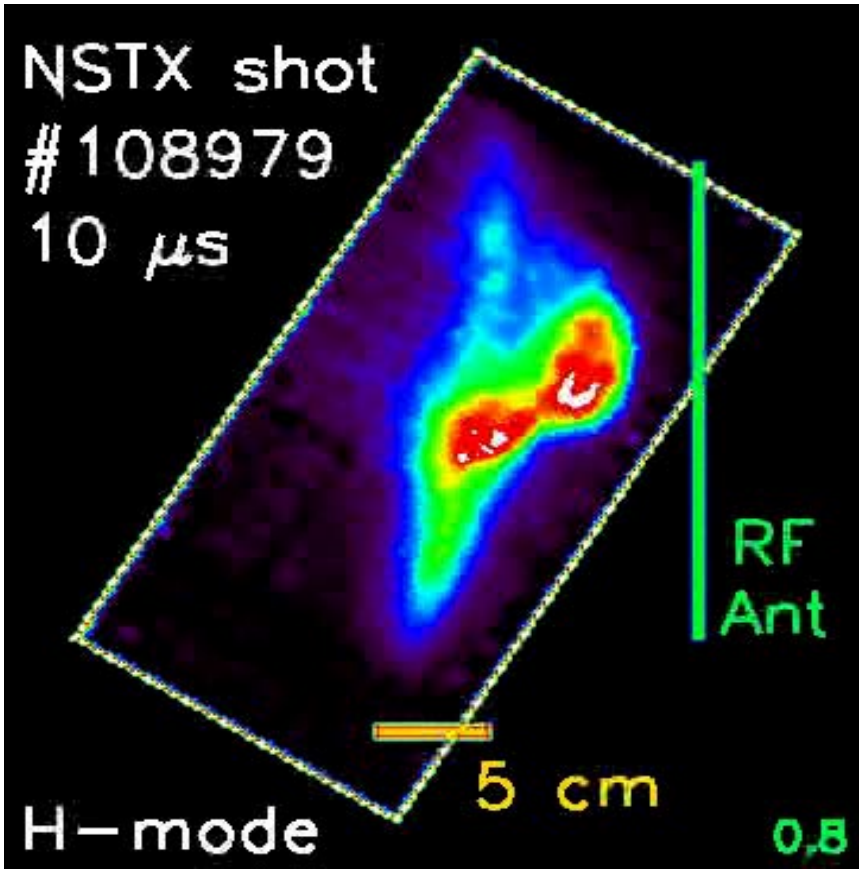
- View light from local He gas puff in HeI (587.6 nm)
- Look along B to make images in radial vs. poloidal plane





Typical Image in NSTX

- **Taken with Princeton Scientific Instruments PSI- 4 camera with 80x160 pixels @ 10 μsec/frame for 28 frames**



Radially outward toward right, ion ∇B and ion diam. down

Separatrix is near "5 cm"

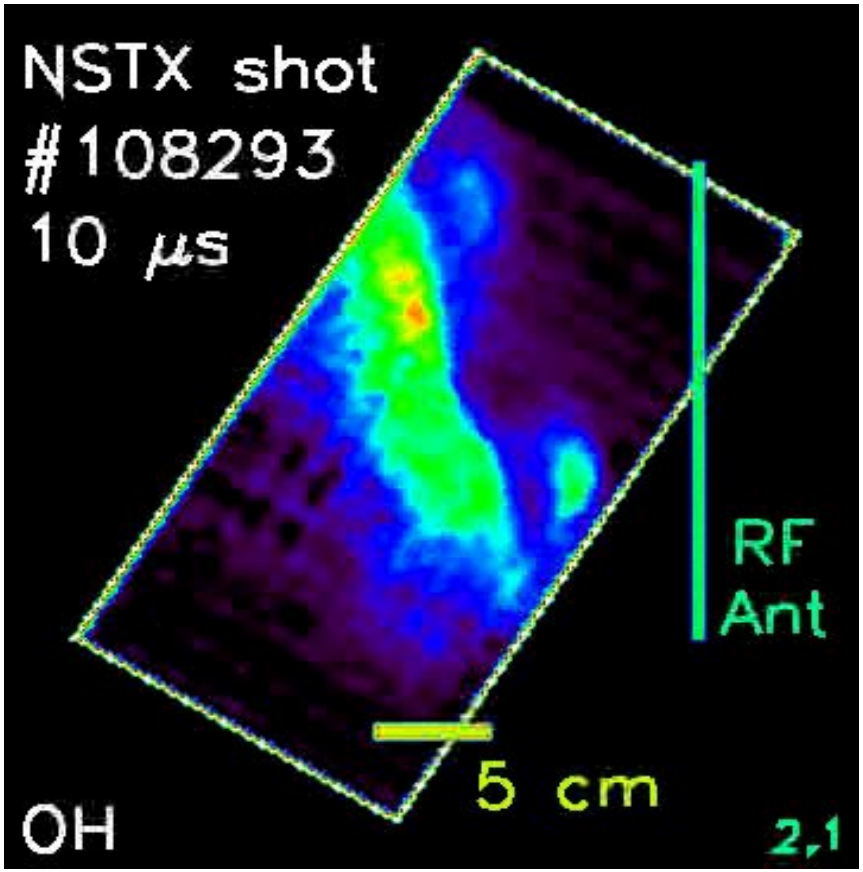
HeI peaks @ Te ≈ 10 eV where:

$$\delta I/I \approx (0.5\text{-}1)\delta n_e/n_e + (0\text{-}2)\delta T_e/T_e$$

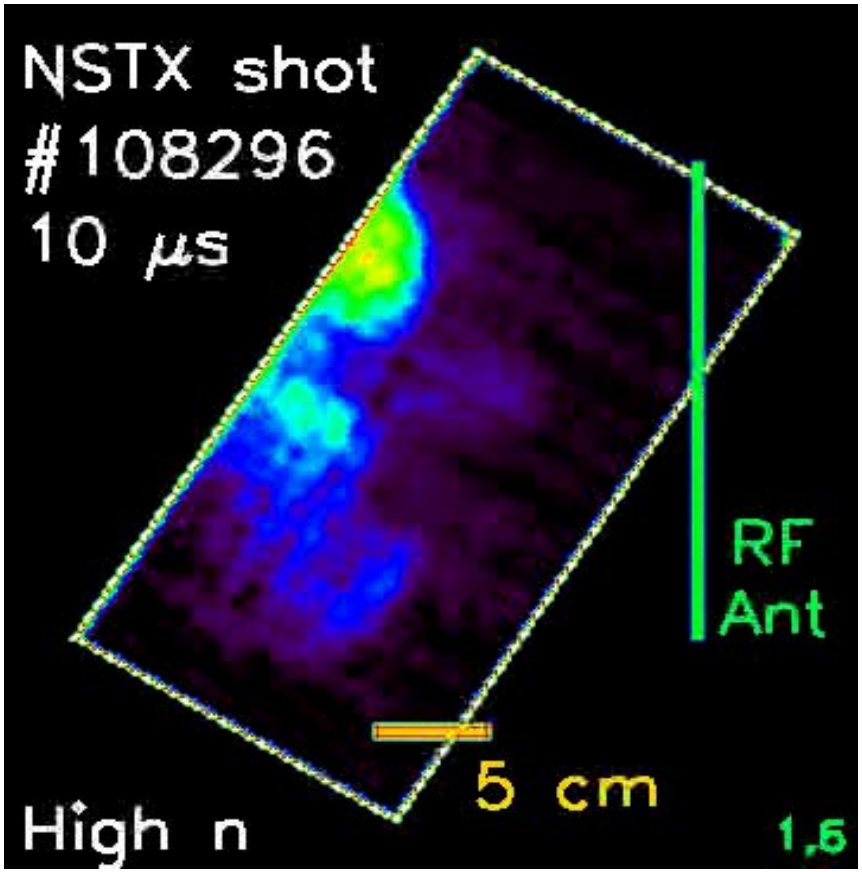
[see Stotler, Tues PM GP1.118]

Ohmic Cases

I=770 kA, B=3 kG

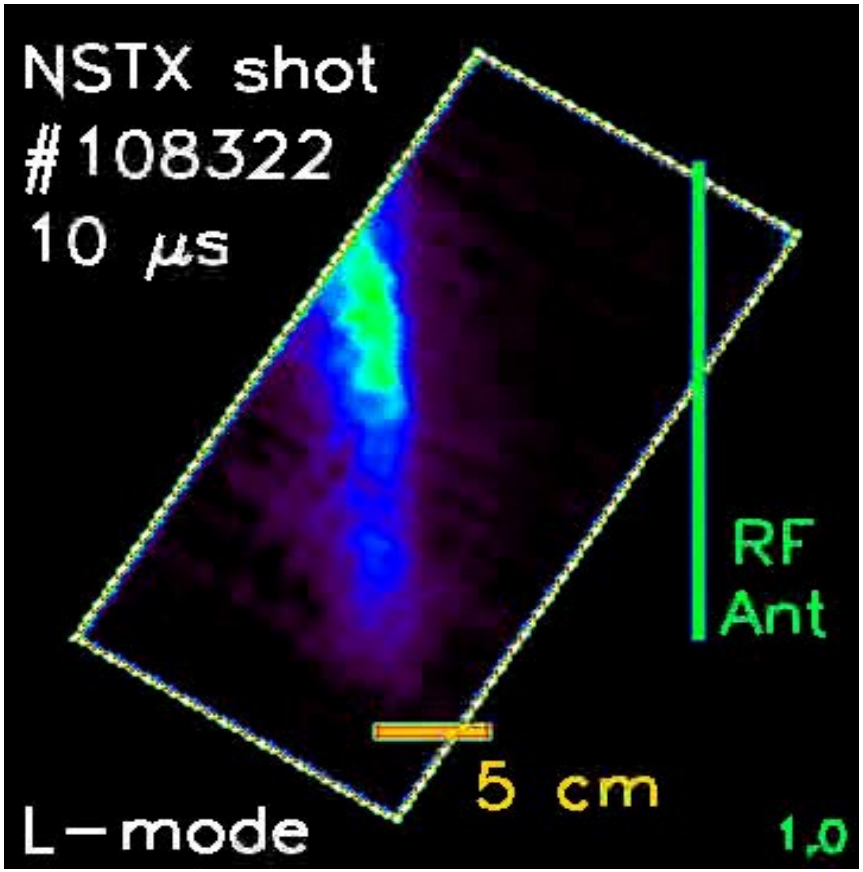


I=780 kA, B=3 kG

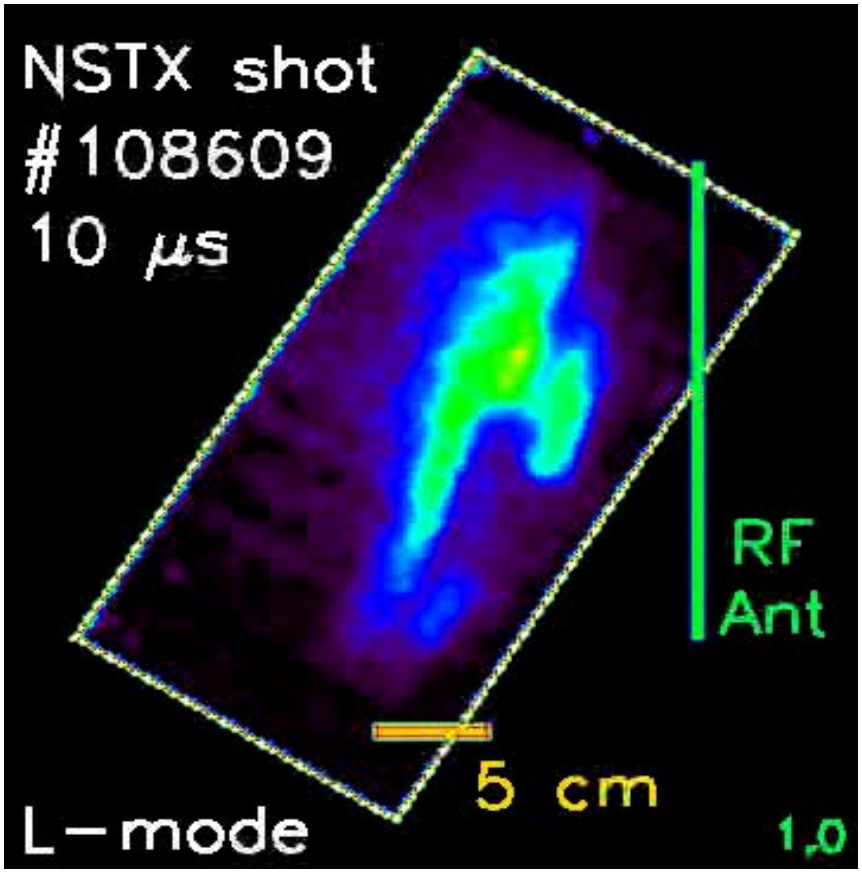


L-mode Cases

I=920 kA, B=3.5 kG

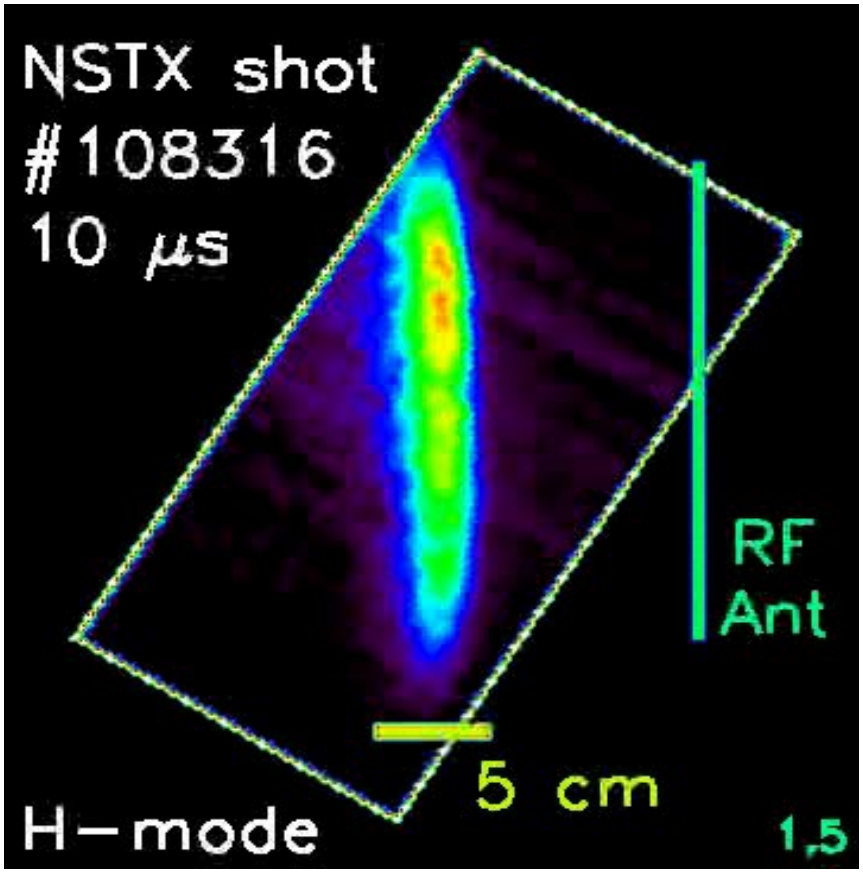


I=900 kA, B=4.5 kG

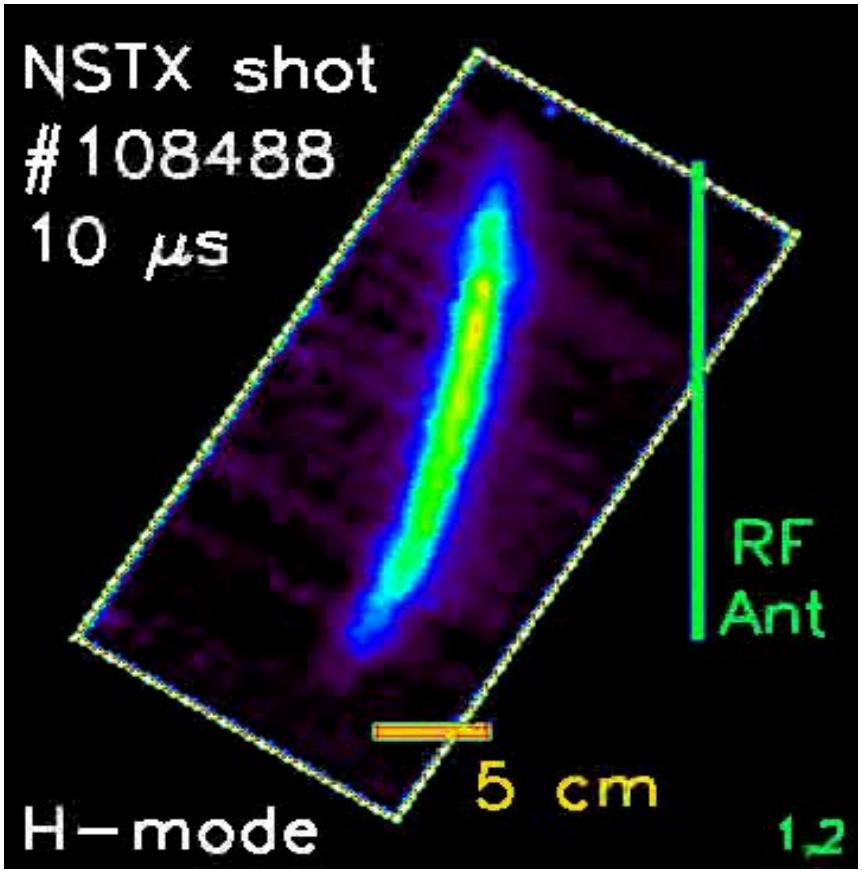


Quiescent H-mode Cases

I=880 kA, B=3.5 kG

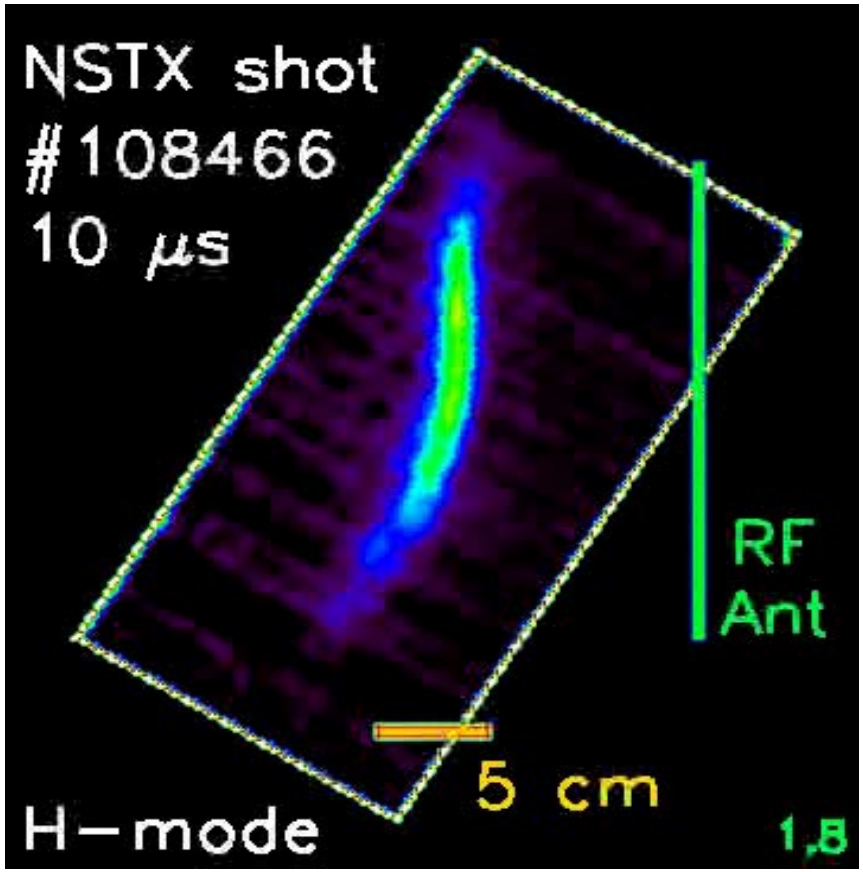


I=920 kA, B=4.5 kG

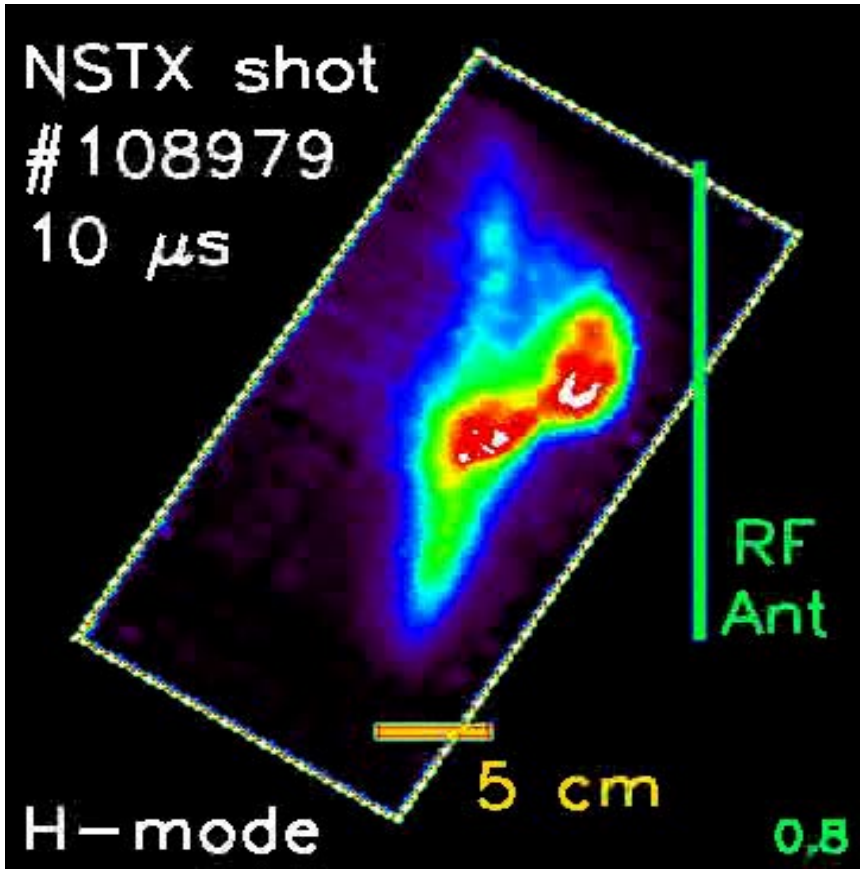


Non-quiescent H-modes

I=900 kA, B=4.5 kG

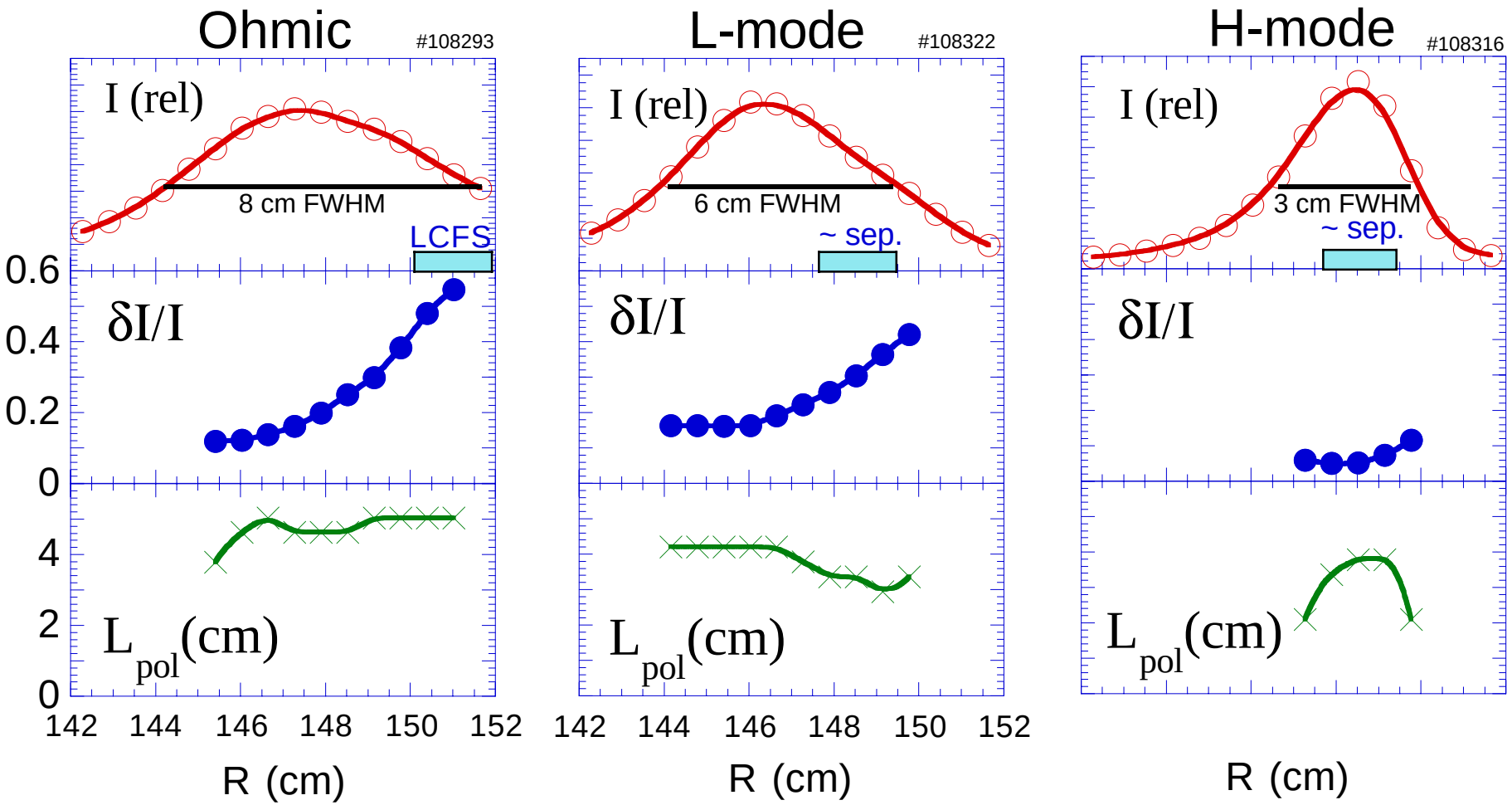


I=880 kA, B=3.5 kG



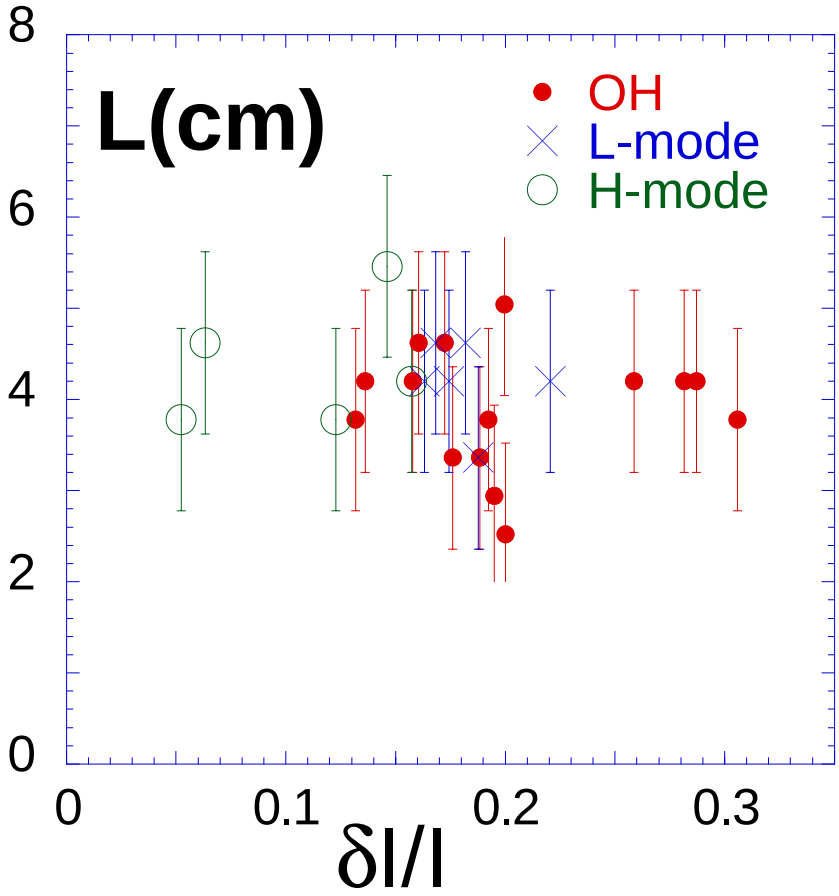
Profiles of δI/I and L_{pol} from Images

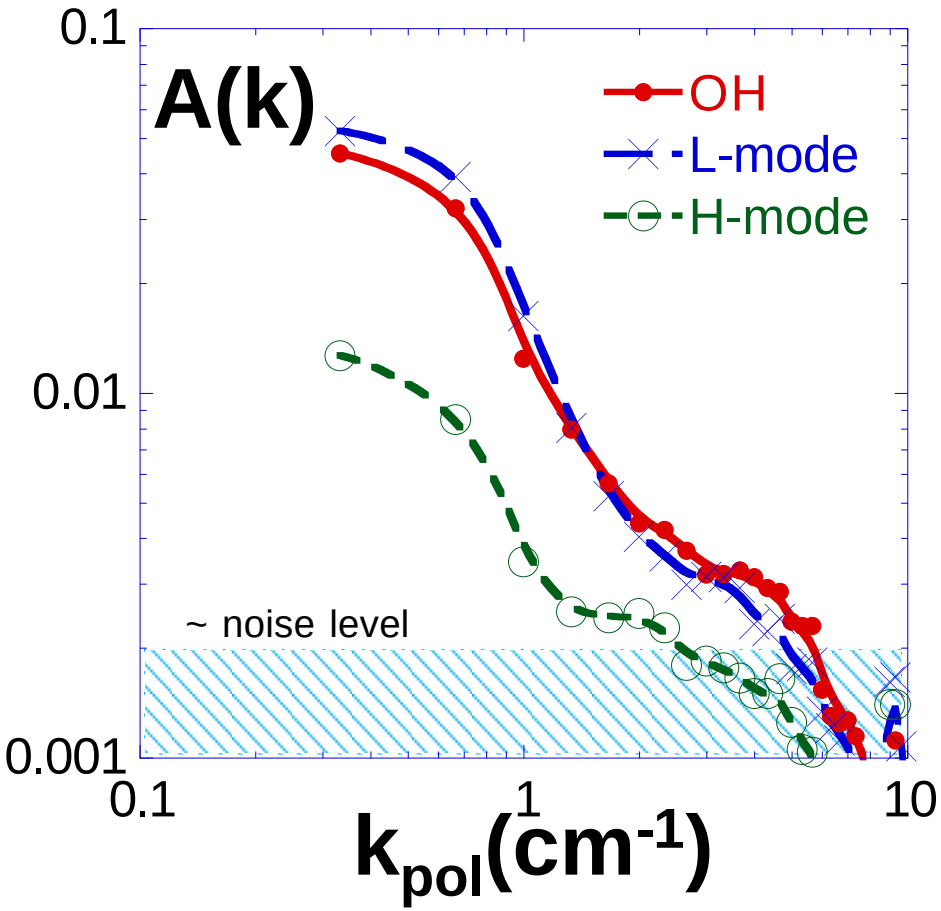
- GPI signal within $T_e \approx 5$ - 20 eV and $n_e \approx 10^{12}$ - 10^{13} cm^{-3}
- Width of GPI emission varies with shape of n and T profiles



Poloidal Correlation Length (FWHM) and k-spectra are similar in OH, L- and H-mode

- Evaluated near peak of GPI signals at $T_e \approx 10$ eV
- Spatial structure is relatively insensitive to atomic physics





Summary

- Poloidal correlation length ≈ 4 ± 1 cm were T_e ≈ 5-20 eV

  => L_{pol} / ρ_s ~ 10-20 or L_{pol} / L_o(RBM) ~ 2-4

- Seems to be some "coherent structure" in 2-D
  - radial or poloidal propagation of localized "blobs"
  - wave-like poloidal structure in H-mode (QCM ?)
  - possible small-scale "zonal flows" (?)

- Further details at this meeting:
  - Maqueda - poster Tues PM - GP1.115
  - Keesee - poster Tues PM - GP1.116
  - Rensink - poster Tues PM - GP1.117
  - Stotler - poster Tues PM = GP1.118
  - Terry - invited talk (C-Mod + NSTX) Wed AM - KI2.001

Effect of He Puff on Edge Turbulence ?

- Turbulence seen in GPI signals does not depend on He puff level over a factor of > 10
- Turbulence seen by reflectometers and probes is ~ the same with or without He puff
- Edge parameters do not change significantly with puff
- Similar edge turbulence seen in recycling light only