

# Neutral Transport Simulations of Gas Puff Imaging Experiments

---

D. P. Stotler, B. LaBombard<sup>1</sup> , B. LeBlanc,  
R. J. Maqueda<sup>2</sup> , J. L. Terry<sup>1</sup> ,  
and S. J. Zweben

*PPPL, <sup>1</sup>MIT, <sup>2</sup>LANL*



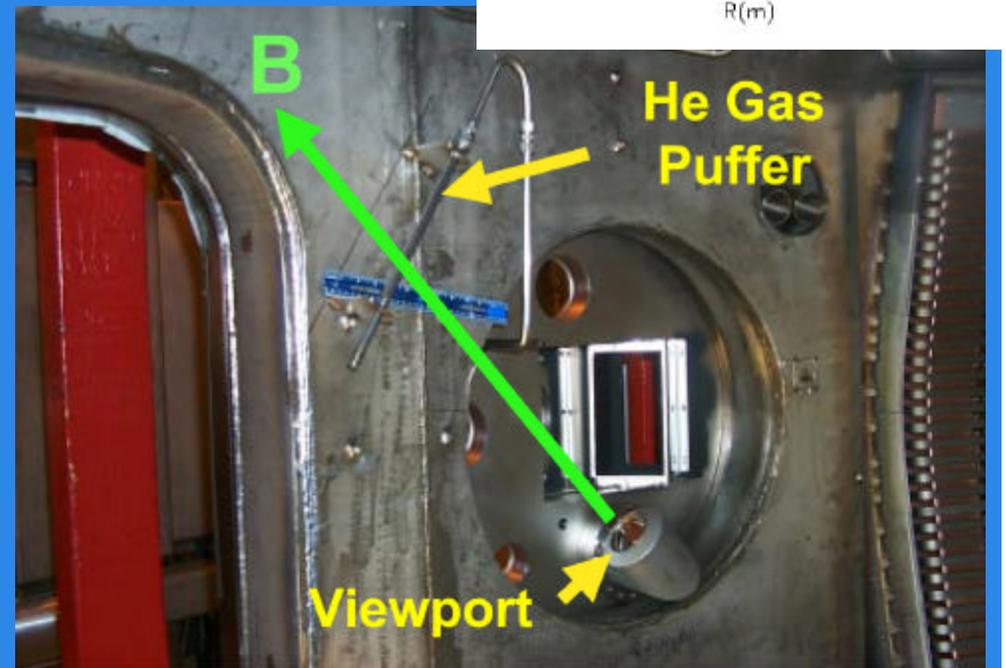
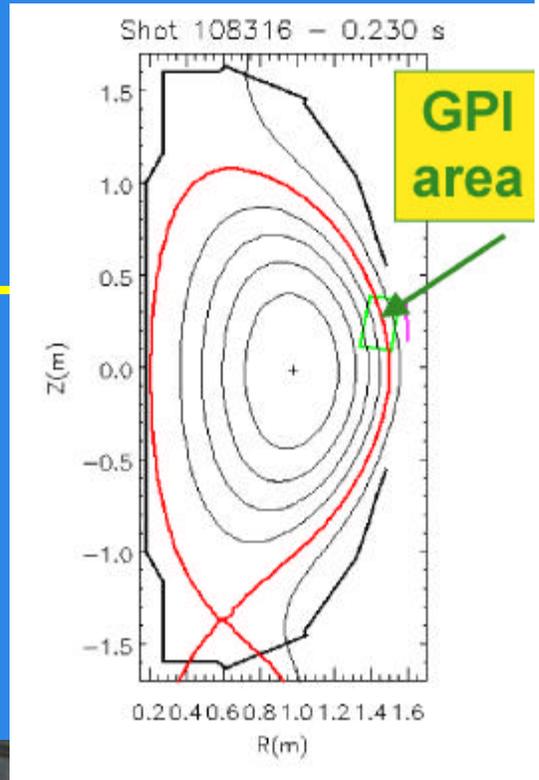
ALPS Meeting

November 6, 2002

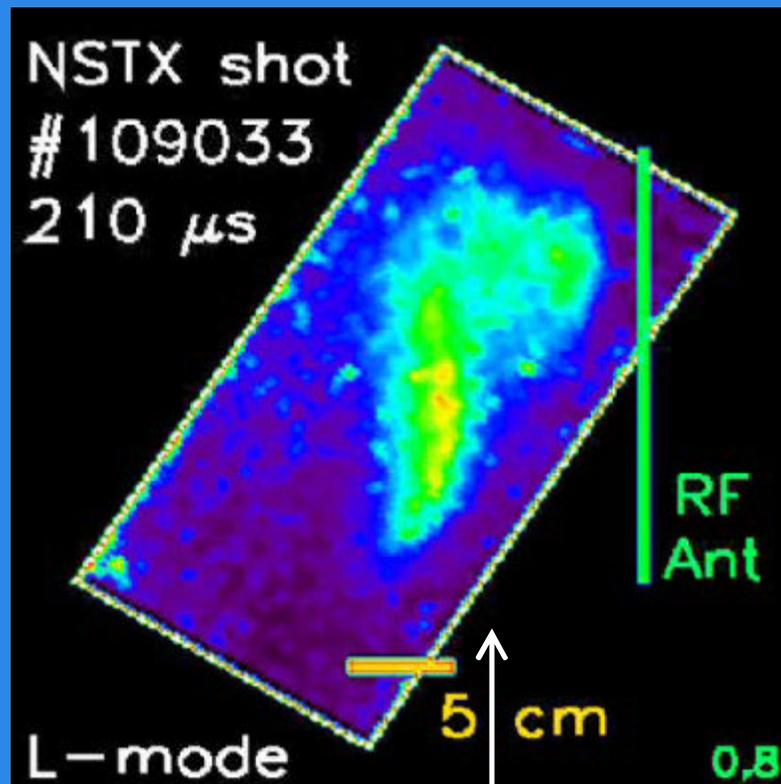


# Gas Puff Imaging (GPI) Experiments Designed to Measure 2-D Structure of Edge Turbulence

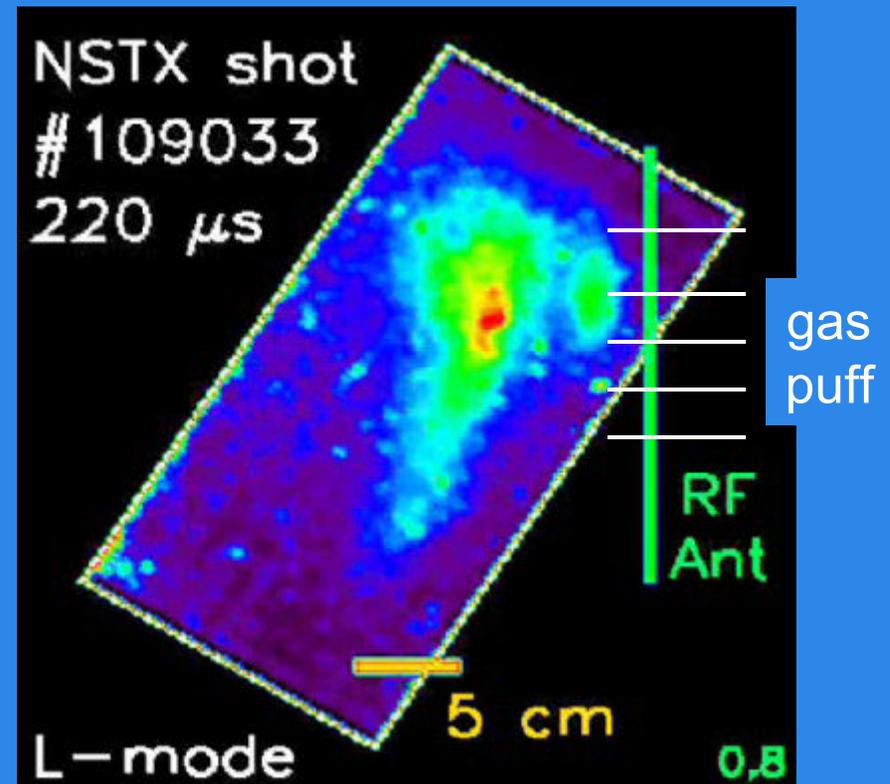
- Puff neutral gas near outer wall,
- View with fast camera fluctuating visible emission resulting from electron impact excitation of that gas,
- Use sightline || to B to see radial & poloidal structure,
  - Compare with turbulence measured by probes,
  - And with output from plasma turbulence codes.



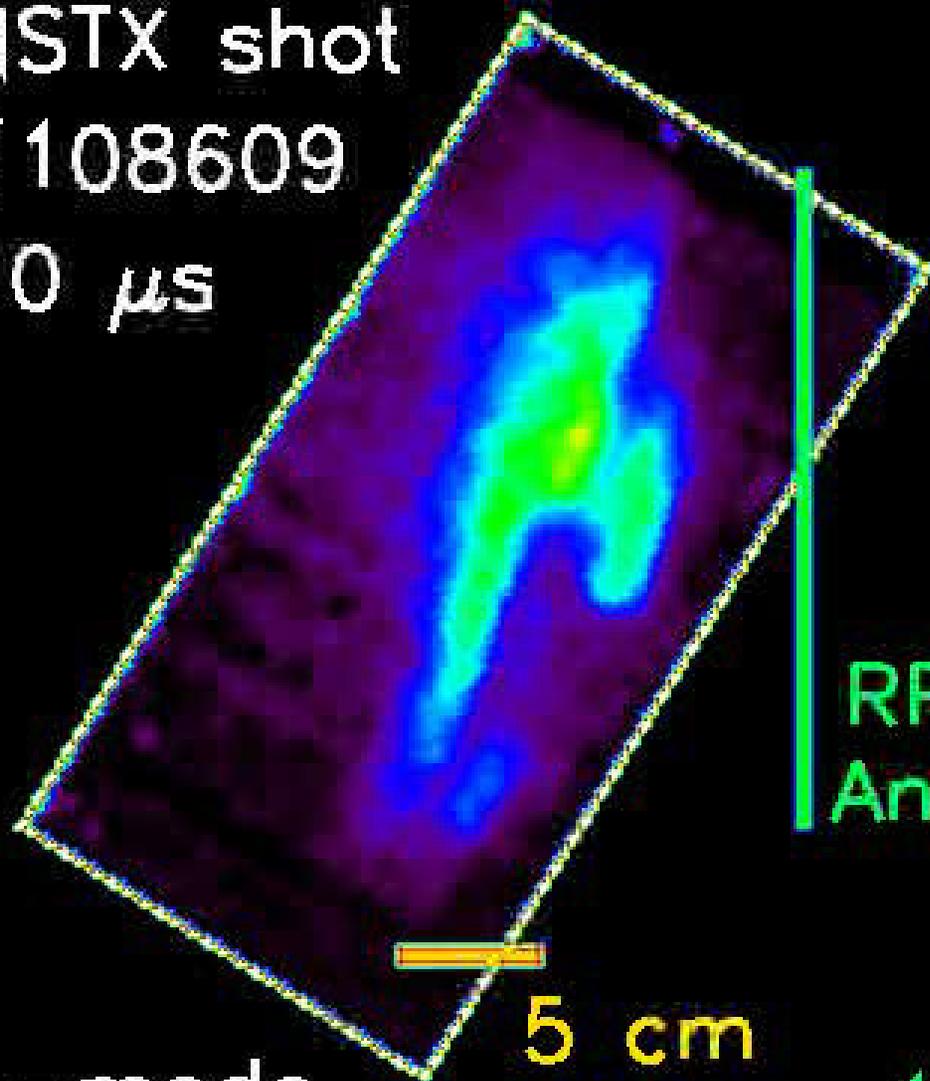
# Camera Records Fluctuating Emission for 28 Frames @10ms/frame



separatrix



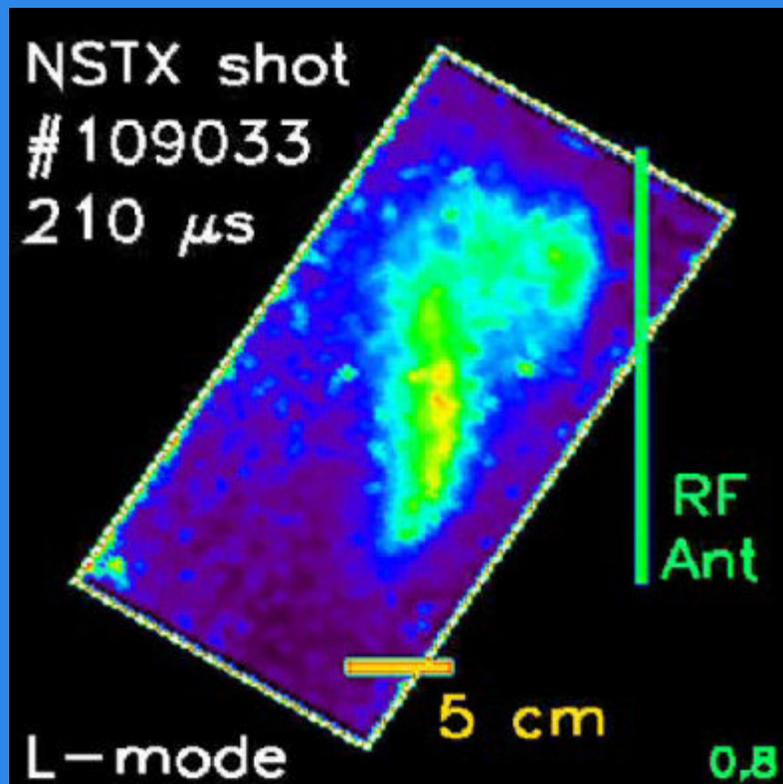
NSTX shot  
# 108609  
10  $\mu$ s



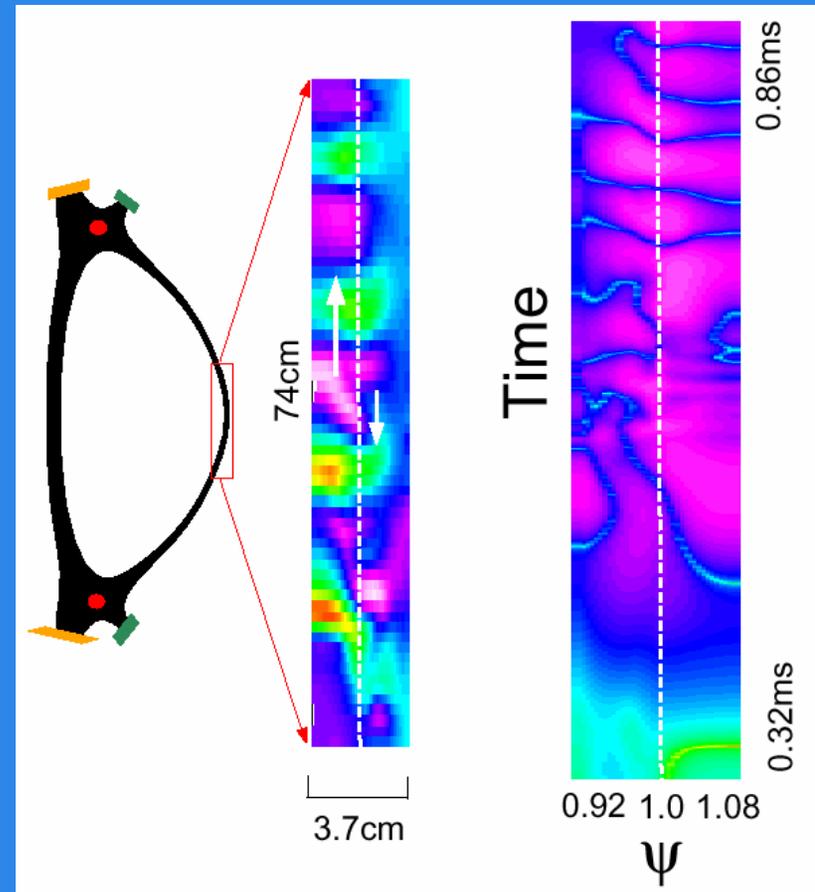
L-mode

1.0

# Examine Relationship Between Observed Emission Patterns & Underlying Plasma Turbulence



Maqueda & Zweben



X. Q. Xu

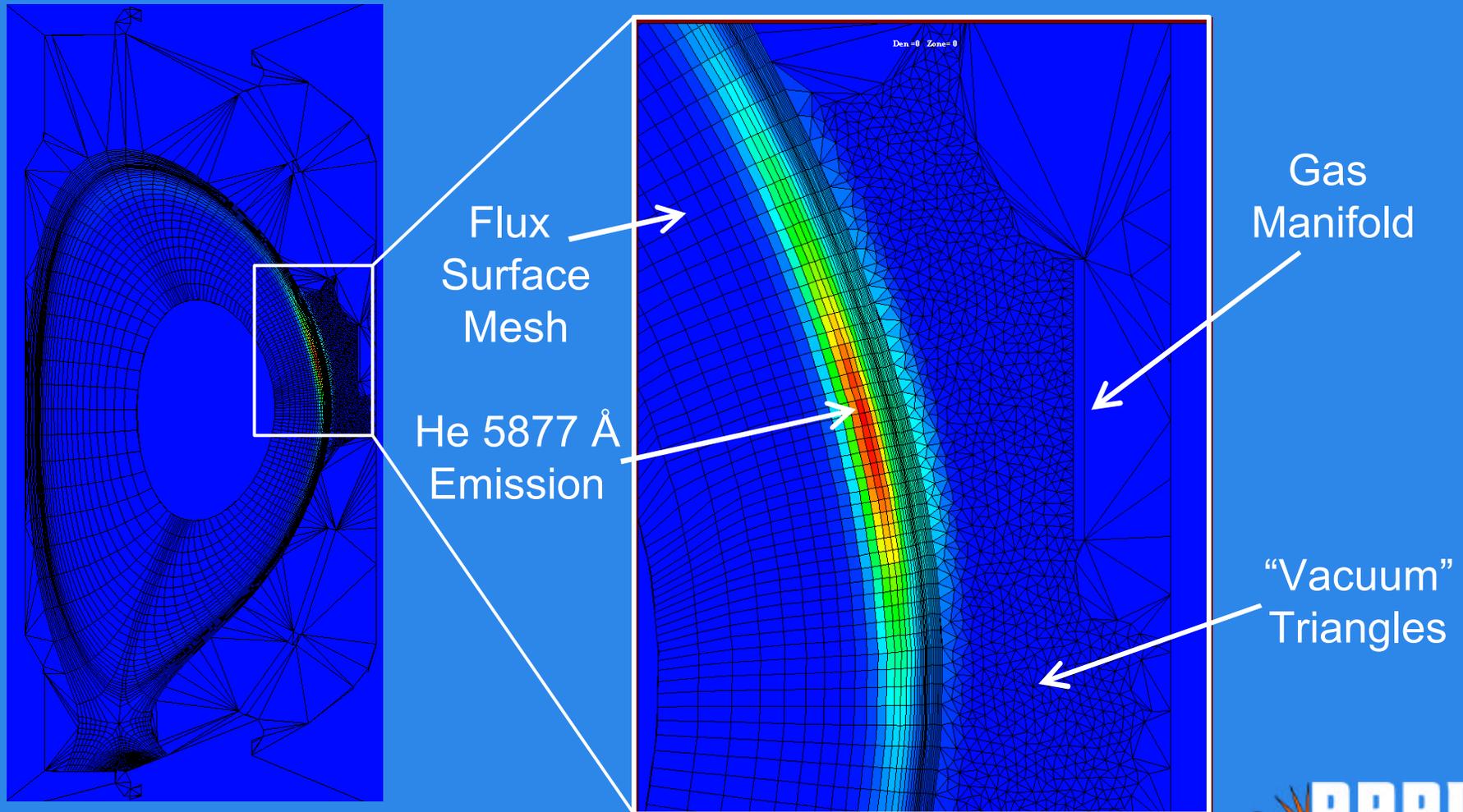
# DEGAS 2 Simulations

---

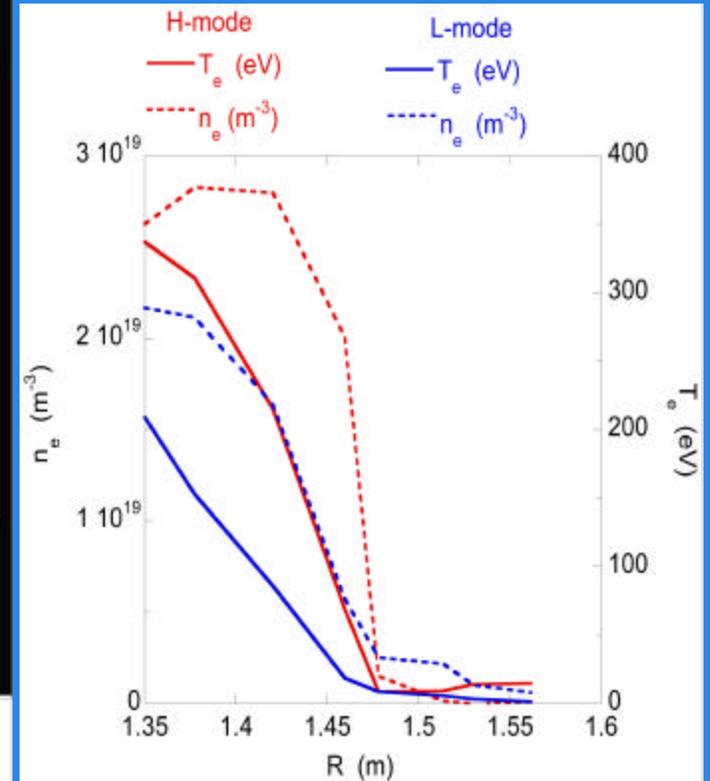
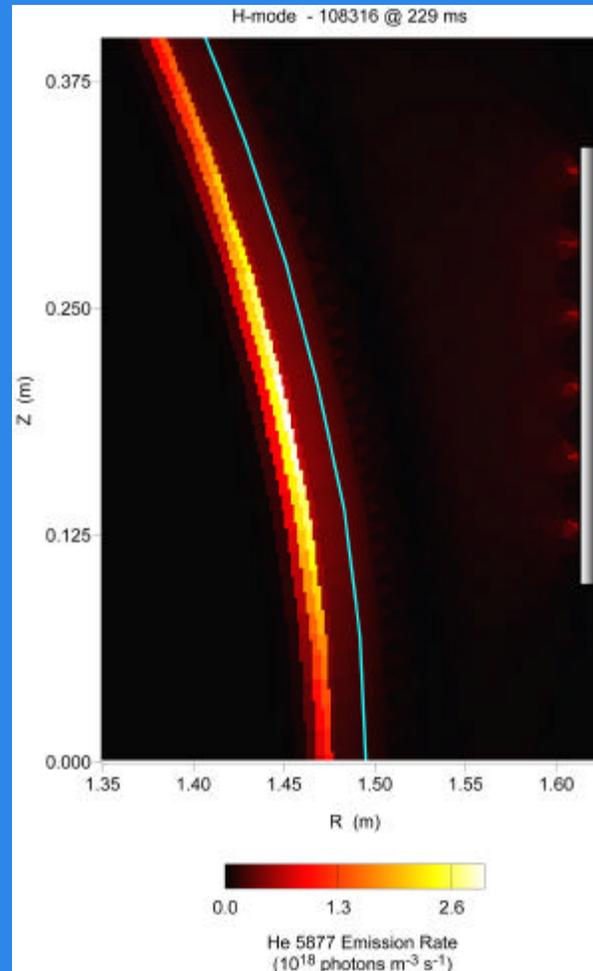
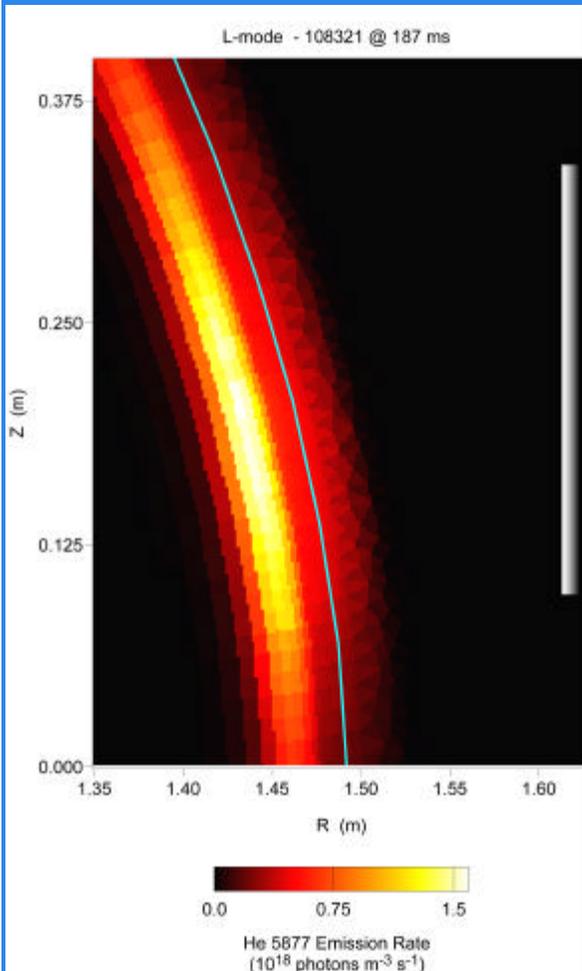
- **Start simple:**
  - **2-D, steady-state neutral transport,**
    - Plasma data input to code,
    - Compute neutral density & line emission,
    - Get emission in poloidal plane ~ camera view.
    - 3-D & time-dependence later.
  - **Use single time-slice  $n_e(R)$  &  $T_e(R)$ ,**
    - Compare with observed avg. cloud size & location.
  - **Or, add ad-hoc 2-D perturbation,**
    - Compare spatial structure of emission with perturbation.
- **Consider  $D_2$  ( $D_a$ ) and He (5877 Å) puffs.**

# Realistic, High Resolution Geometry

## NSTX Shot 108321, 187 ms



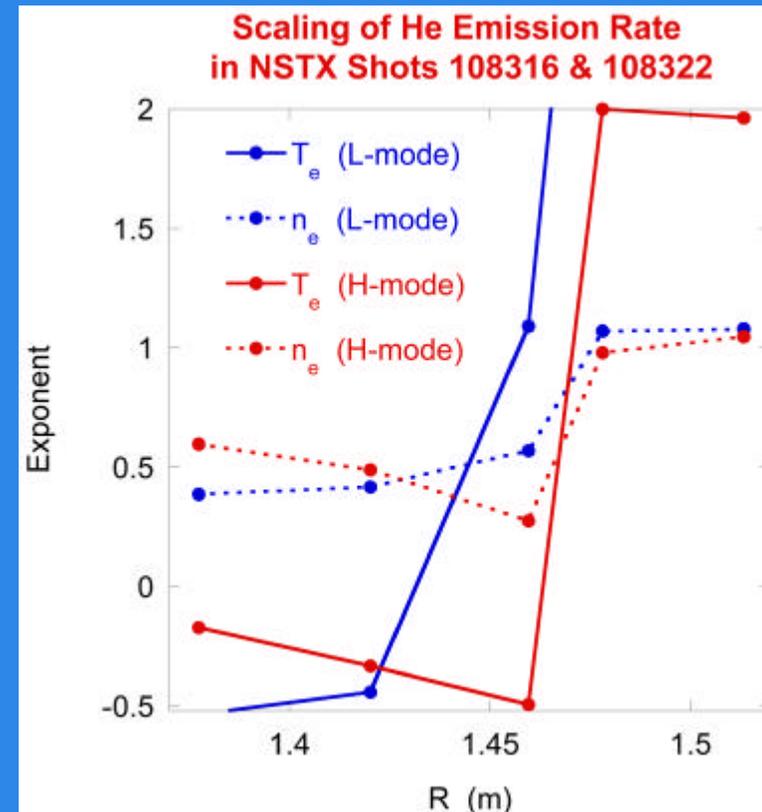
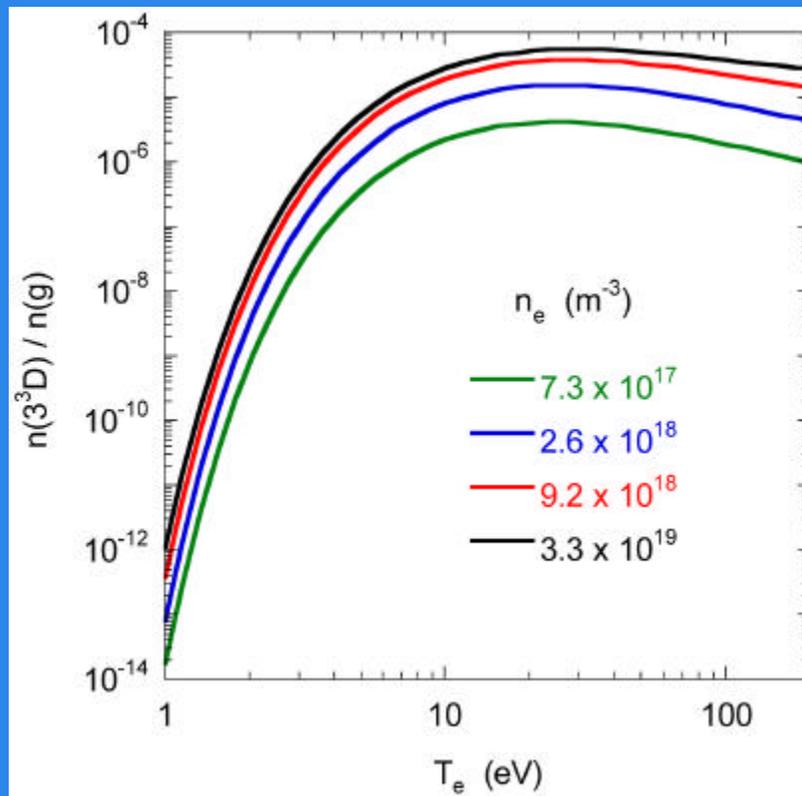
# Width of Emission in NSTX Simulations Determined by Profiles



# Scaling of Emission Rate for He 5877 Å Varies Across Profile

$$S = \sum_j n_j f_j(n_e, T_e)$$

$n_e, T_e$  Dependence of  $f$  for He 5877 Å



# Spatial Structure of Plasma Variation Apparent in Simulated Emission

