

# XP #1067: Edge Zonal Flows and Blob Formation

S.J. Zweben, R. Maqueda, T. Munsat, Y. Sechrest, S.M. Kaye,  
D. D'Ippolito, J. Myra, D.A. Russell, R. Hager, K. Hallatschek,  
L. Roquemore, D. Smith, S. Kubota, K. Tritz, F. Poli, A. Diallo

NSTX Physics Meeting 8/9/10

Motivation: understand the relationship between edge zonal flows and blob formation in NSTX

XP Goal: determine scaling of edge zonal flows with  $B_t$  (at constant  $q$ ) and with NBI power using GPI, and measure correlation with blob formation

Plan: B=3.5 kG, I=0.7 MA - six shots w/NBI  
B=4.5 kG, I=0.9 MA - six shots w/NBI  
B=5.5 kG, I=1.1 MA - six shots w/NBI

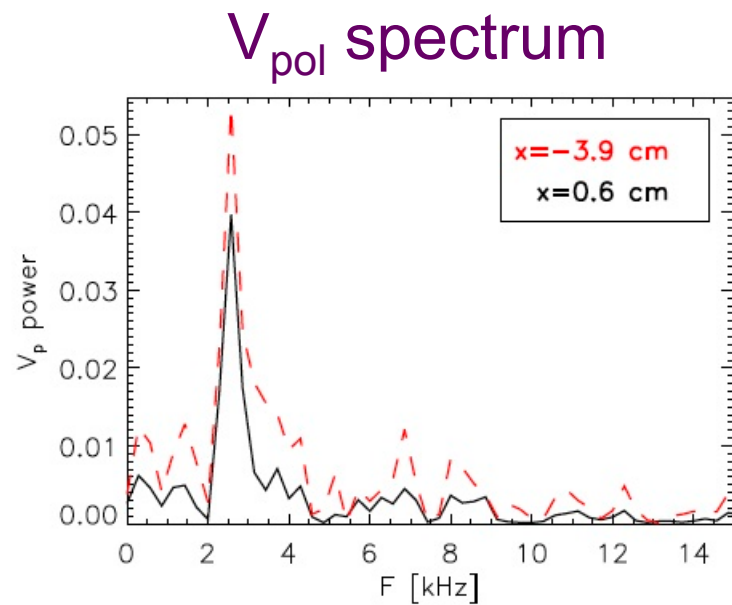
# Overview

- Zonal flows in theory regulate edge turbulence and may help to cause the L-H transition (e.g. Diamond et al, PPCF 2005)
- Many observations have been made of GAMs and a few of incoherent, lower frequency zonal flows (Fujisawa NF 2010)
- Edge zonal flows were observed in NSTX for the first time last year during run with 'ultra-high GPI rate' (XP#929), based on analysis of poloidal velocity of GPI turbulence
- That data was all at  $B=4.5$ ,  $I=0.9$  MA,  $P \sim 2$  MW NBI using two cameras with combined rate of 285,000 frames/sec

This XP will scan B and use a new camera at 400,000 fr/sec

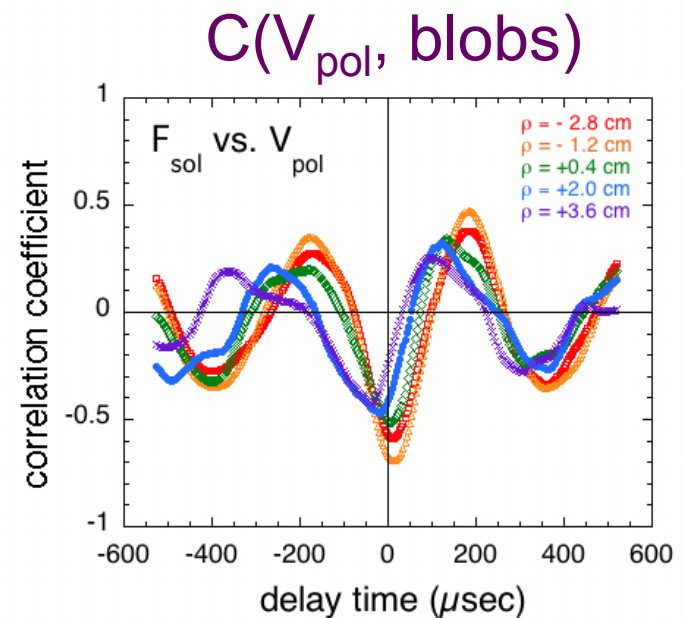
# Edge Zonal Flows and Blob Formation

- Poloidal flows in GPI were observed to oscillate at  $\sim 3$  kHz in L-mode plasmas in 2009 ( $I=0.9$  MA,  $B=4.5$  kG)
- Quiet periods (i.e. absence of blob formation) was also observed at  $\sim 3$  kHz, correlated with edge zonal flows



Sechrest, Munsat et al to be published

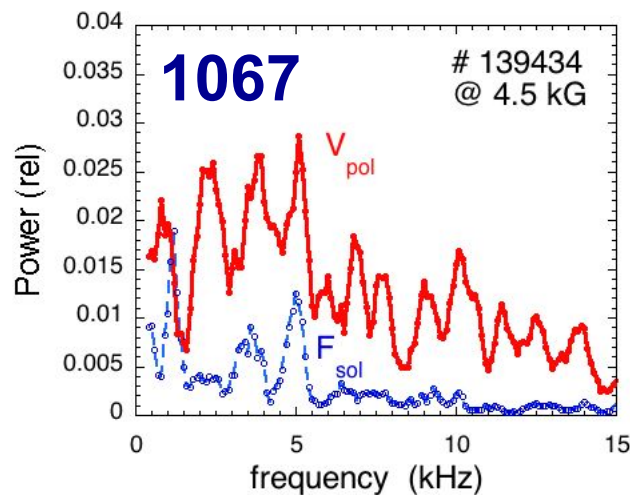
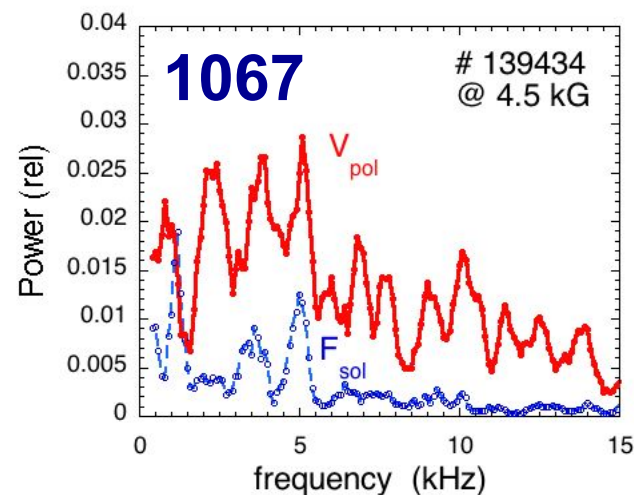
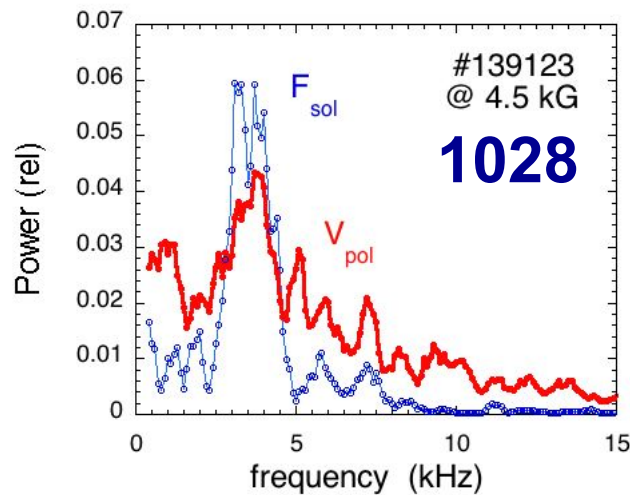
XP 1067



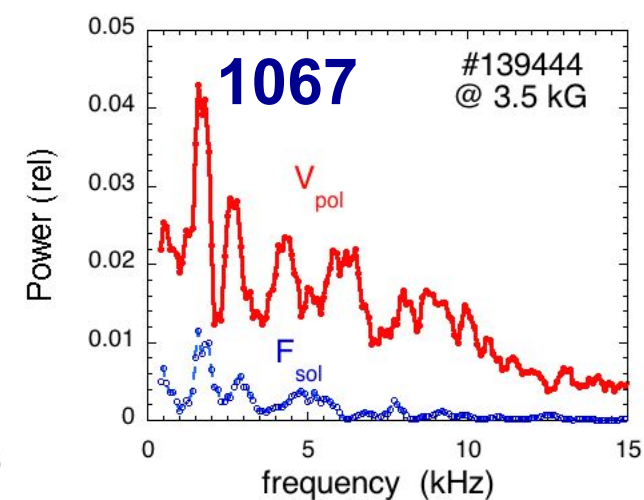
Zweben, Maqueda et al PoP 2010

# Sample ZF-Blob Frequency Spectra

- Spectra in XP #1067 appear more complex than previously

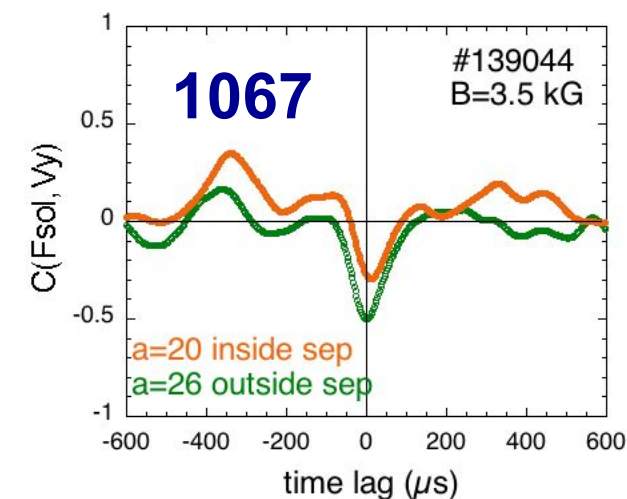
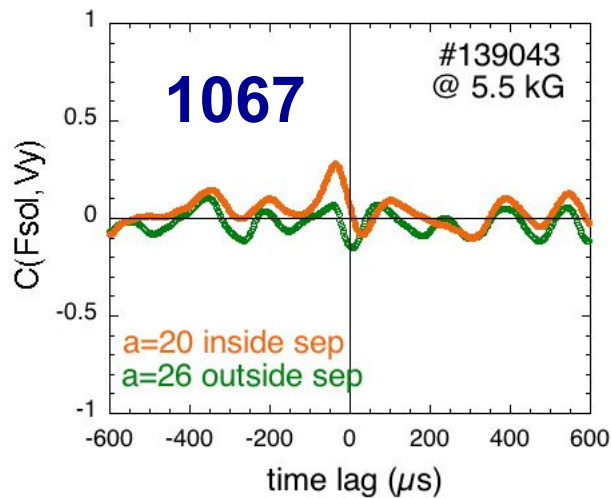
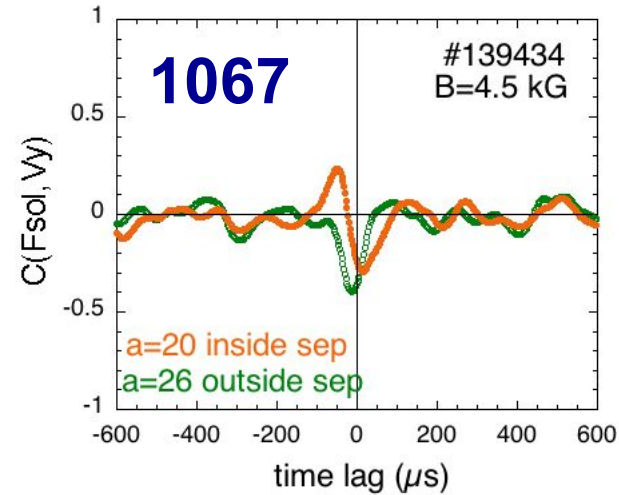
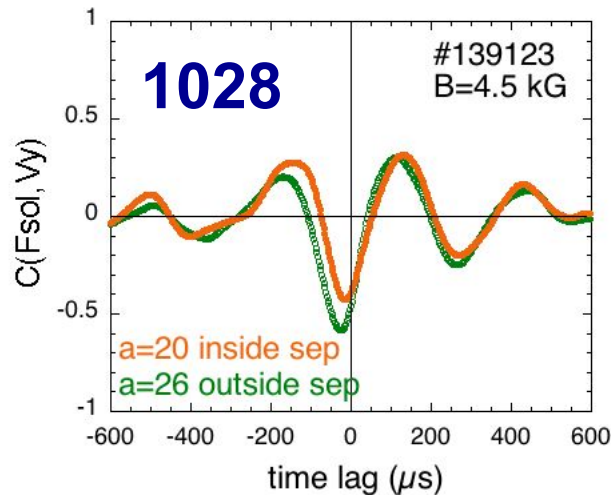


XP 106



# Sample Correlation of ZF vs. Blobs

- Correlation of ZF ( $V_y$ ) and blobs ( $F_{sol}$ ) also more complex



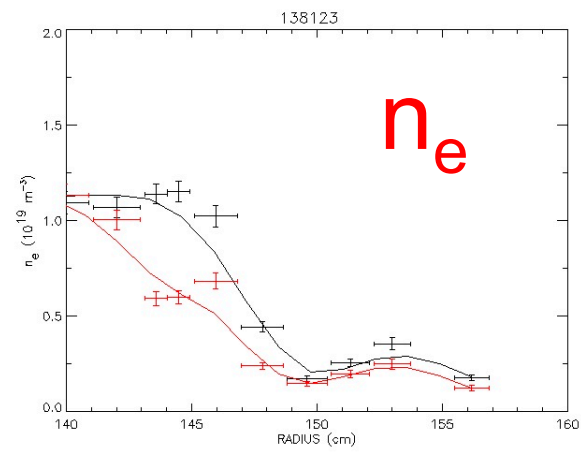
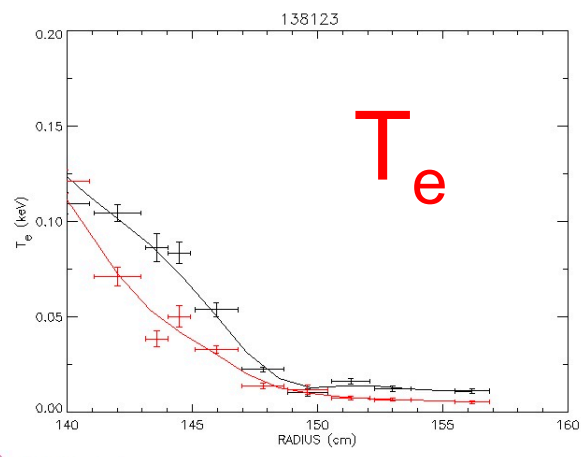
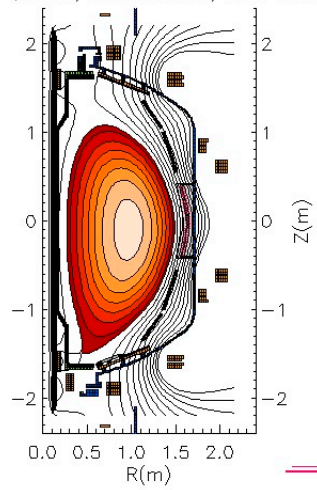
# Summary of XP#1067

- Results were more complicated than expected based on previous shots earlier this year (and last year)
- Zonal flow spectra had multiple peaks  $\sim 1-10$  kHz and correlation of zonal flow with quiet periods less clear
- Why do results appear to be more complex in 2010 ?
  - didn't notice this previously ?
  - edge profile changes ?
  - plasma shape changes ?
  - influence of other MHD ?

# Comparison of #138123 vs. #139435

138123

from \EFIT02, Shot 138123, time=225ms



139135

from \EFIT01, Shot 139434, time=249ms

