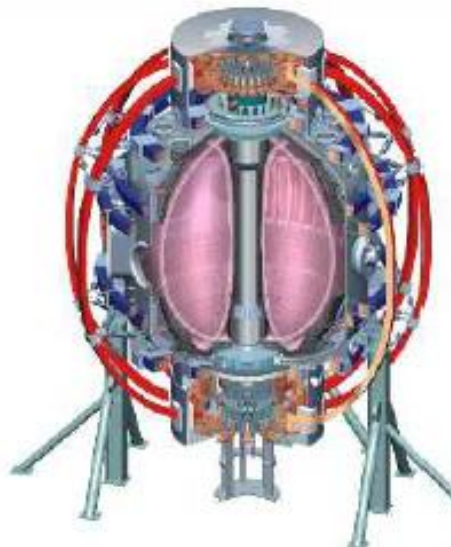


Transport and Turbulence TSG Mid-run Status

Howard Yuh, TSG Leader
Stan Kaye, TSG Deputy Leader
Taik-Soo Hahm, Theory & Modeling
FY10 NSTX mid-run assessment
Aug 27, 2010

College W&M
 Colorado Sch Mines
 Columbia U
 Comp-X
 General Atomics
 INL
 Johns Hopkins U
 LANL
 LLNL
 Lodestar
 MIT
 Nova Photonics
 New York U
 Old Dominion U
 ORNL
 PPPL
 PSI
 Princeton U
 Purdue U
 SNL
 Think Tank, Inc.
 UC Davis
 UC Irvine
 UCLA
 UCSD
 U Colorado
 U Maryland
 U Rochester
 U Washington
 U Wisconsin

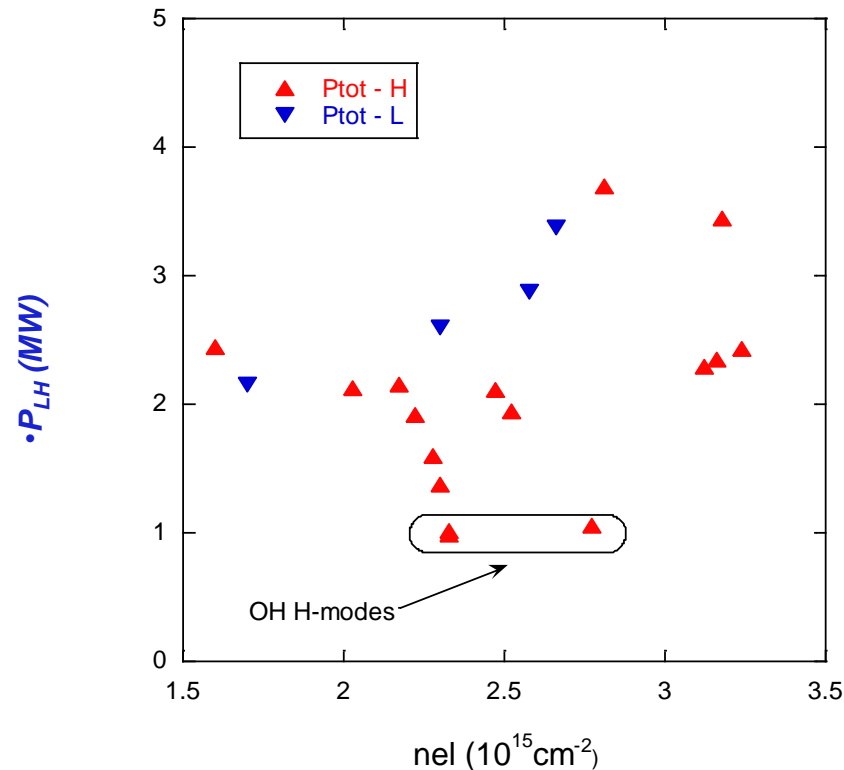


Culham Sci Ctr
 U St. Andrews
 York U
 Chubu U
 Fukui U
 Hiroshima U
 Hyogo U
 Kyoto U
 Kyushu U
 Kyushu Tokai U
 NIFS
 Niigata U
 U Tokyo
 JAEA
 Hebrew U
 Ioffe Inst
 RRC Kurchatov Inst
 TRINITI
 KBSI
 KAIST
 POSTECH
 ASIPP
 ENEA, Frascati
 CEA, Cadarache
 IPP, Jülich
 IPP, Garching
 ASCR, Czech Rep
 U Quebec

Summary of T&T XPs having received runtime

XP1028 (0.5 ITER) - Density dependence of L-H threshold (Kaye)

- Higher P_{LH} seems to increase with increasing n_e
- Non-reproducibility precludes definitive conclusions
- Not requesting more runtime



Summary of T&T XPs having received runtime

XP1041 (0.5) - Joint NSTX DIII-D poloidal rotation experiment (R. Bell)

- XP compares measured and neoclassical poloidal velocities.
- Sensitive to gradient in impurity profiles.
- Good target plasmas were obtained, but due to vents just prior to XP, large but unknown amounts of nitrogen & argon present.
- Impurity content during run was uncertain, so comparison not possible.

XP1042 (0.5) - Intrinsic torque using torque transients (Solomon)

- Unsuccessful Attempt To Measure Intrinsic Torque following LLD experiments
- Infer effective torque associated with intrinsic rotation drive by applying NBI torque steps and looking for “missing” torque
- Li “blob” resulted in poor plasma conditions
 - Typically strong MHD throughout shot, with little or no quiescent phase, confusion with significant drag caused by low-n modes
 - Highly irreproducible discharges
 - Both moderate and high triangularity shots attempted
 - Half day essentially spent trying to clean blob

XP #1067: Edge Zonal Flows and Blob Formation

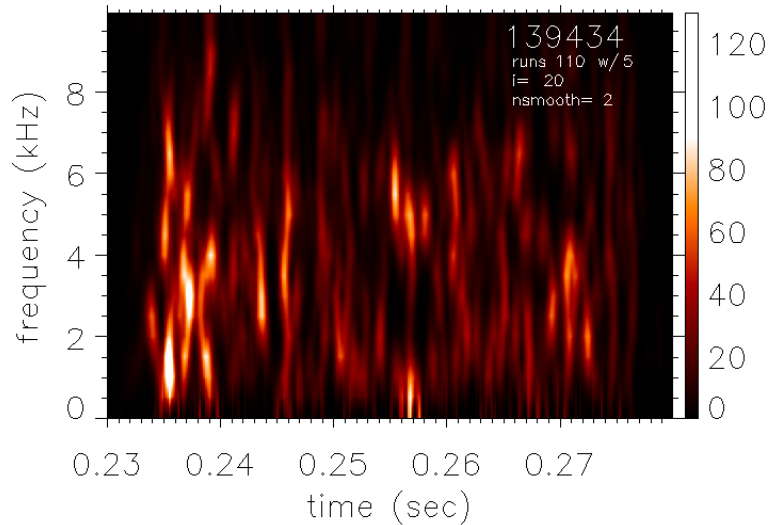
XP1067 (0.5) – Edge Zonal Flows and Blob Formation

(S.J. Zweben, R. Maqueda, T. Munsat, Y. Sechrest, S.M. Kaye et al)

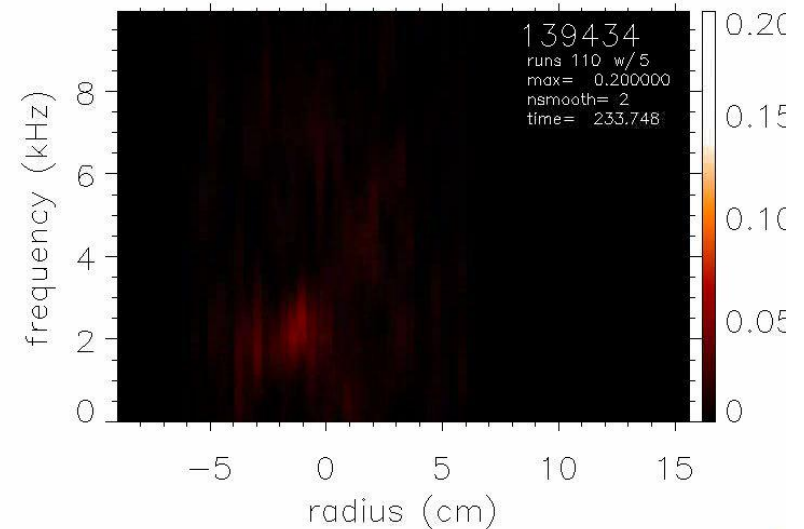
Goal: Use GPI to determine scaling of edge zonal flows with B at fixed $q(a)$

Result: Obtained good GPI data, but ZF spectra more complex than expected

•ZF spectra vs. time ($\rho \sim -1$ cm)



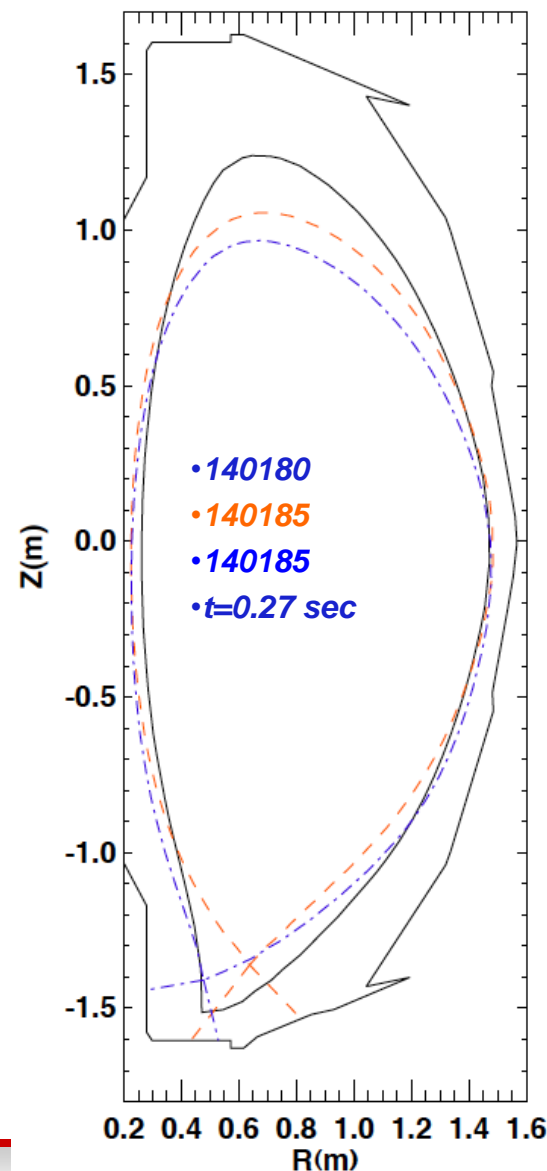
•ZF spectra vs. radius vs. time



•Need time to understand these results, not more run time !

Three X-point geometries and triangularities achieved in XP1029, and P_{LH} measured in each

- Goal was to measure P_{LH} for 2 or 3 different R_x at constant X-point height
- P_{LH} was higher for the **smaller R_x** shape than the **larger R_x** , at least for transitions that produced stable H-modes afterwards
 - Small R_x , low X-point shape didn't have matched B_t or fueling
- Propose to compare the P_{LH} with lower lithium (~50mg between discharges), that should result in a clearer change in P_{LH} , and/or do an intermediate R_x shape if time permits (XP was allocated 4 hrs but run only for 2.5 hrs) (ITER)



Remaining T&T Priority 1 XPs, Requirements (1 of 2)

XP1037 (1.0) - Parametric Dependence of High-k Turbulence (Ren)

High-k turbulence dependence on ν , B_t , I_p

Requires: high-k at R=135cm and 117cm

Desirable: BES, reflectometer, FReTIP

XP1038 (0.5+0.5) - Investigation of multi-scale turbulence (Smith, Kubota)

Parameter scan affecting low-k turbulence that doesn't overlap with XP936

Requires BES, reflectometer

Desirable: high-k, FReTIP

XP936 (1.0+0.5) - Impact of rotation on energy and momentum transport (Kaye, Smith, Solomon)

Uses n=3 braking to affect rotation, adds BES this year.

Requires: BES (outboard only ok)

Desireable: reflectometer, high-k, FReTIP

XP1042 (0.5) - Intrinsic torque using torque transients (Solomon)

Requires MHD quiescent phase to avoid additional drag sources

Remaining T&T Priority 1 XPs, Requirements (2 of 2)

- XP1039 (0.5) - Comparison of turbulence in Ohmic H-mode (Kubota, Lee)
Fluctuation differences in L/H using correlation reflectometer,
measure ion-neutral Renold's number
Requires: reflectometer, FReTIP, GPI
Desireable: BES, high-k
- XP1040 (0.5+0.5) - Sustained reversed shear ITBs at reduced power (Yuh)
Turbulence/transport evolution as smooth function in shear
Requires: RF (1-2MW), high-k.
Desirable: BES, reflectometer, FReTIP
- XP1036 (1.0) - P_{L-H} for D and He plasmas using RF (Battaglia, Zweben)
Requires: RF ramps (2+MW), GPI
Desirable: BES, reflectometer, FReTIP
- XP1041 (0.5) - Joint NSTX DIII-D poloidal rotation experiment (R. Bell)
Initial half day unsuccessful due to high impurities
Requires: Low non-carbon impurity content

T&T Priority 2 XPs and additional XP ideas

XP1013 (0.5) - *AE induced electron transport (Tritz)

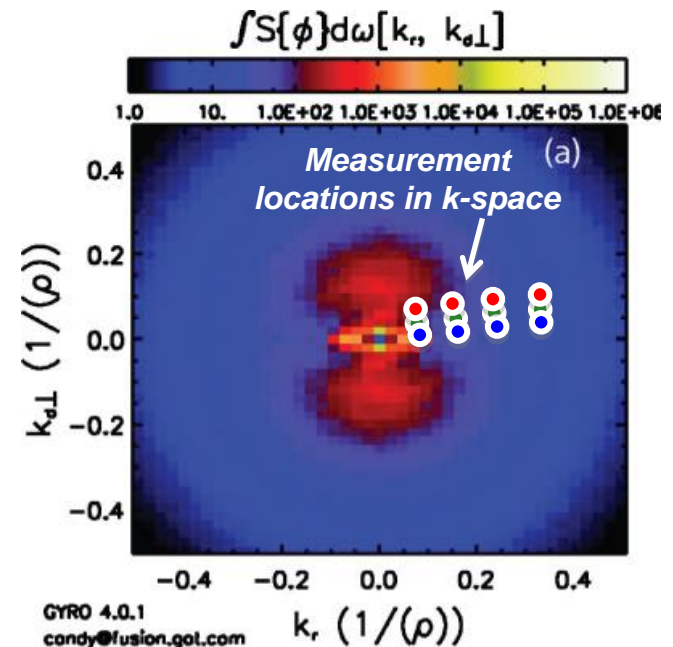
Requires: Inboard BES

Desireable: reflectometer, high-k, FReTIP

Investigation of ETG turbulence isotropy (Smith)

Requires: High-k.

- According to simulations, **ETG** turbulence is **anisotropic** when low-k fluctuations are linearly stable or when flow shear suppresses low-k fluctuations.
- According to simulations, only **anisotropic** ETG turbulence can generate experimentally-relevant electron transport.
- The NSTX high-k system is **uniquely capable** of confirming the existence of anisotropic ETG turbulence by adjusting k_θ/k_r ratio in measurements.



Fluctuation Diagnostics Status

- **BES**

- 16 channels operational (6/2010) at outer view ($0.5 < r/a < 1+$); 32 channels planned, 9/2010
- Currently, ops requires Bay F LiTER to be off to protect in-vessel optics
- Inner view ($\sim 0.1 < r/a < \sim 0.8$) expected ~ 1 week, pending R130 shutter fix

- **High-k**

- Using solid state source now, full availability
- Routinely operated and improved alignment allows 5 channel simultaneous ops

- **FIReTIP**

- 3 channels including one edge channel are operating with upgraded time resolution (12 MHz sampling rate/4 MHz band width)

- **Reflectometer**

- Q-band fixed frequency reflectometer currently inoperable
- Availability estimated week of 9/6. Required / desired for several XPs