(TG2) Turbulence Topical Group Report

Nov. 10, 2021 (T. Kobayashi)

Date: Nov. 9, 2021
Time: 10:00 – 18:45
Shot#: 172008 – 172043, 172138 – 172157 (56 shots)

Prior wall conditioning: D2
Divertor pump: On except for 2-I
Gas puff: D_2, Ar, SSGP
Pellet: None

NBI#(1, 2, 3, 4, 5)=gas(H, D, D, D, D)=P(3.7, 2.3, 2.7, 0, 5.0)MW

ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(700, 790)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(980, 930, 990)kW
ECH(56GHz)=ant(1.5U)=P(290)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.58, 0.58, 0.87, 0.50)MW
Neutron yield integrated over the experiment = 4.3×10^{16} (TG2 and TG4 total)

Topics
1. Turbulence suppression with boron powder injection (F. Nespoli and S. Masuzaki)
2. Electromagnetic turbulence in high beta plasmas (A. Alonso and Y. Suzuki)

Turbulence suppression with impurity powder dropper

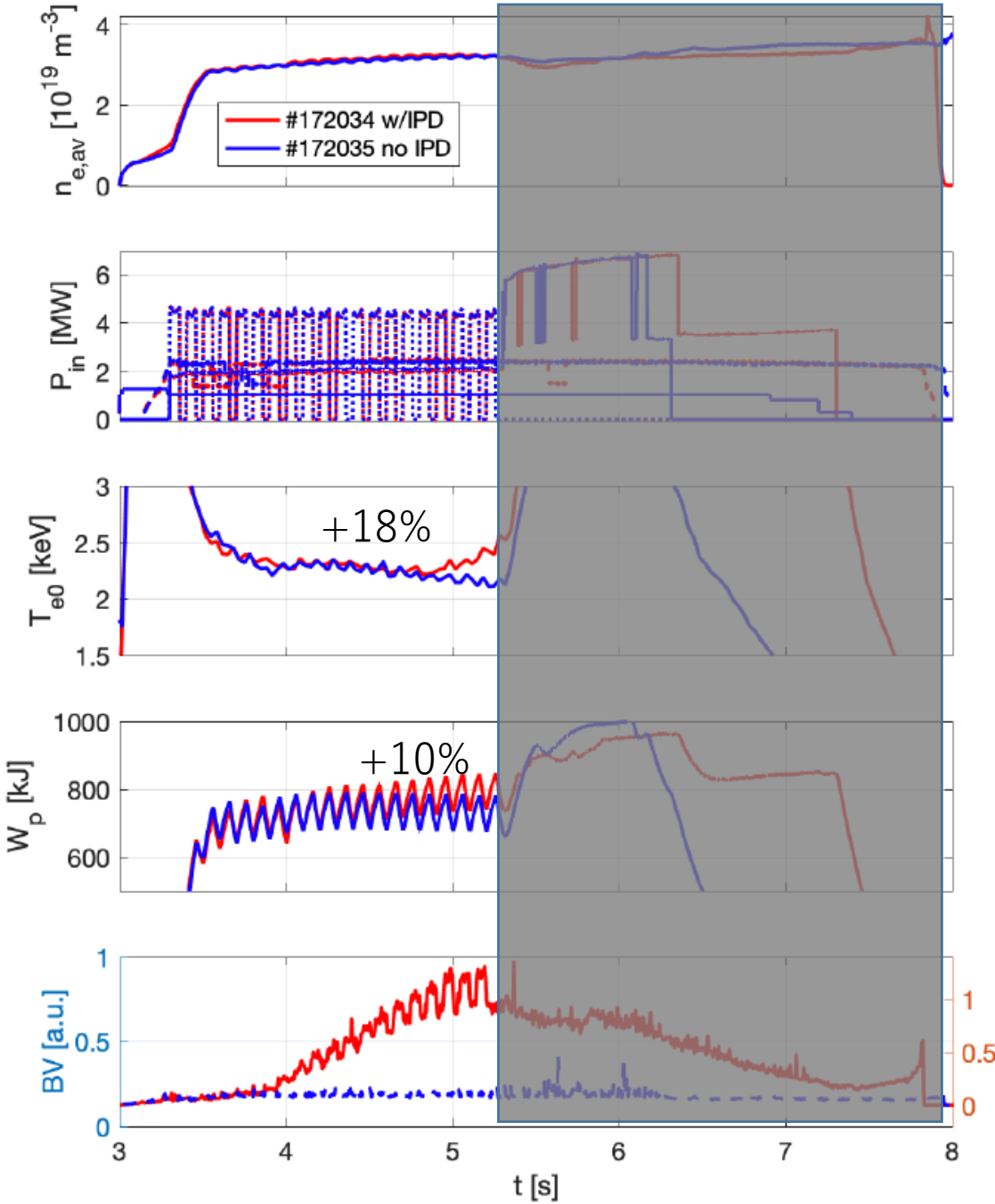
F. Nespoli et al.

2021.11.09 R_{ax}=3.55m

- Problems with stable NB operation
- Time needed to extend ECH and ICH operation
- Problems with FIR for density control

- Only a few useful shots by the end of the experiments
- C powder injection performed for comparison. Density increased and plasma collapsed. Need more shots to tune C drop rate.

- Results: temperature and stored energy increase observed in ECH+ICH+NB shot with B injection.
- Turbulent density fluctuations halved
- Consistent with previous results
- Still, 2 seconds is too short, steady state not reached. Longer shots needed, as requested: turbulence suppression and temperature increase might be stronger.



PPPL PRINCETON PLASMA PHYSICS LABORATORY

NIFS

Turbulence suppression with impurity powder dropper

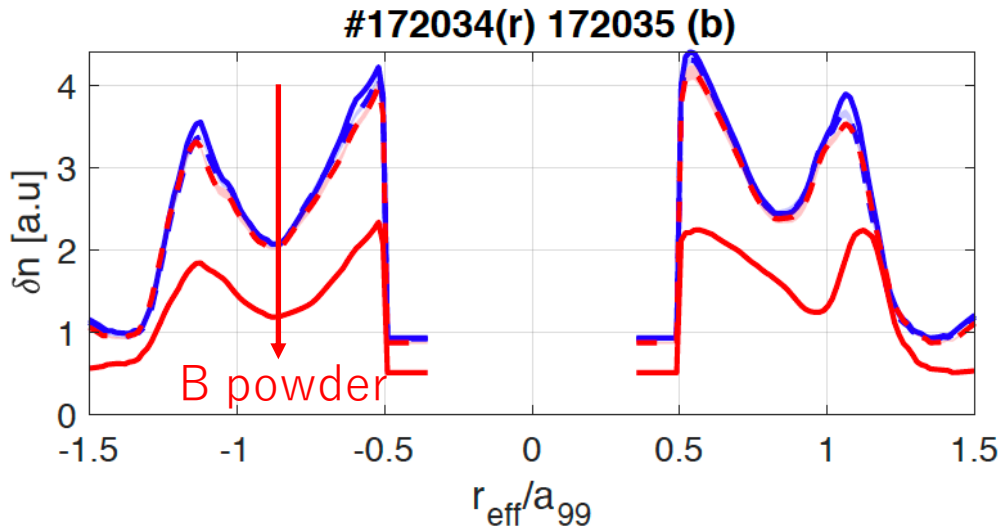
F. Nespoli et al.

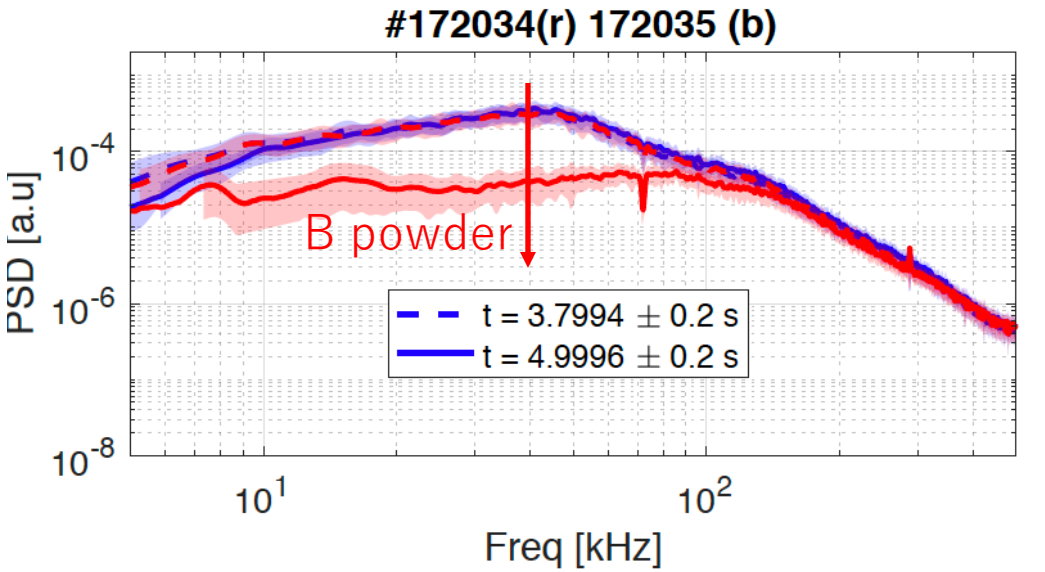
2021.11.09 R_{ax}=3.55m

- Problems with stable NB operation
- Time needed to extend ECH and ICH operation
- Problems with FIR for density control

- Only a few useful shots by the end of the experiments
- C powder injection performed for comparison. Density increased and plasma collapsed. Need more shots to tune C drop rate.

- Results: temperature and stored energy increase observed in ECH+ICH+NB shot with B injection.
- Turbulent density fluctuations halved
- Consistent with previous results
- Still, 2 seconds is too short, steady state not reached. Longer shots needed, as requested: turbulence suppression and temperature increase might be stronger.





PPPL PRINCETON PLASMA PHYSICS LABORATORY

NIFS

Electromagnetic turbulence in high beta plasmas

A. Alonso and Y. Suzuki

Shot #: 172137-172157

Experimental conditions:

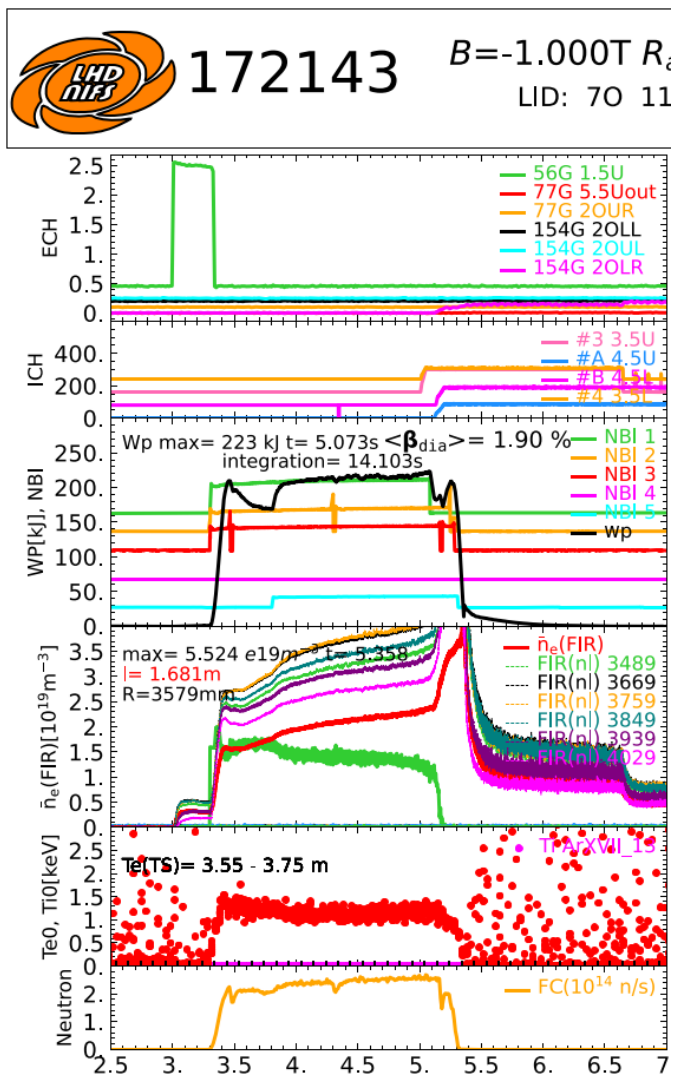
(R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CCW, 1.0 T, 1.2538, 100 %)

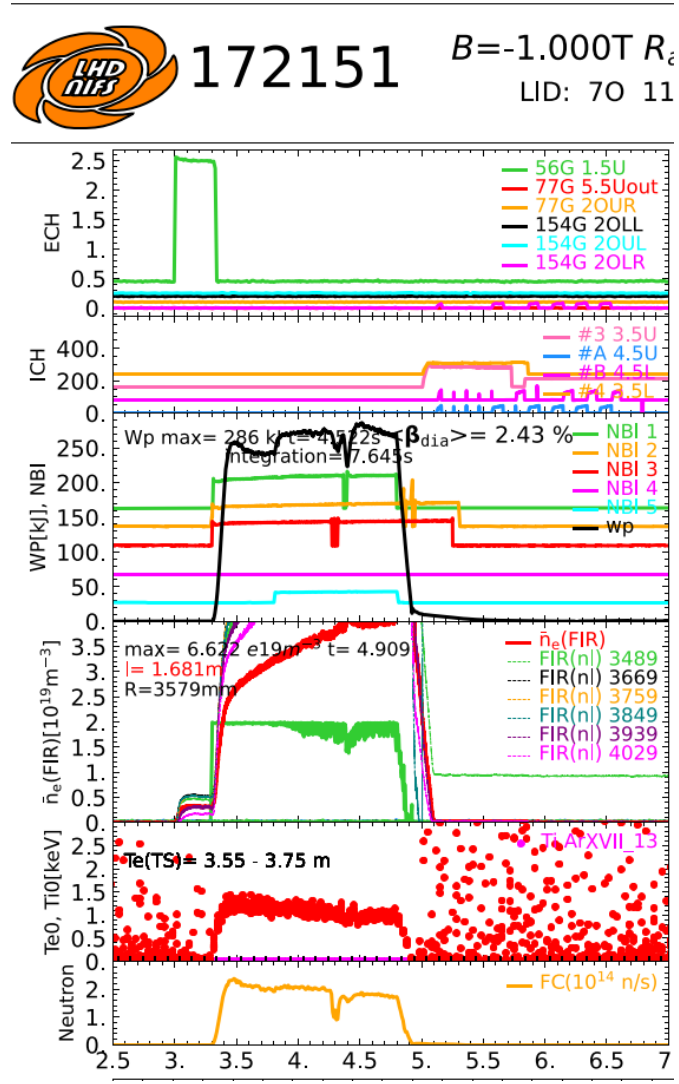
Motivation and objective:

- Research in present large stellarator devices needs to firm-up the physics basis for extrapolation to fusion reactors.
- Scaling laws are at present our basis for extrapolation.
- LHD has shown deviations when trying to approach reactor collisionality and beta (possibly related to EM turbulence) workshop).
- Objective: Characterize plasma EM fluctuations when approaching reactor relevant thermal and fast-ion betas.

Results:

- Medium and high-beta discharges are obtained for deuterium plasmas.
- ICH wall conditioning was tried.





2.43% is the highest beta for deuterium plasmas.