(SG3) Instability & Anisotropy group report

Apr. 23, 2024 (T. Kawate)

Date: Apr. 19, 2024
Time: 10:50 – 14:30
Shot#: 189901 – 189969 (69 shots)
Prior wall conditioning: Yes (He)
Divertor pump: No
Gas puff: H_2, Ar, He, Ne

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(4.4, -, -, 3.1, 5.4)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, 0.71)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.71, 0.89, 0.98)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.60, -, 0.62, 0.70)MW

Topics

1. Interplay of fast ions and impurities in LHD in helium (D. Moseev (IPP), K. Tanaka)
2. Impurity exhaust by 3-ion heating at LHD (D. Moseev (IPP), K. Tanaka)

Interaction of fast ions and impurities with sawteeth in He plasmas

Experimental conditions:

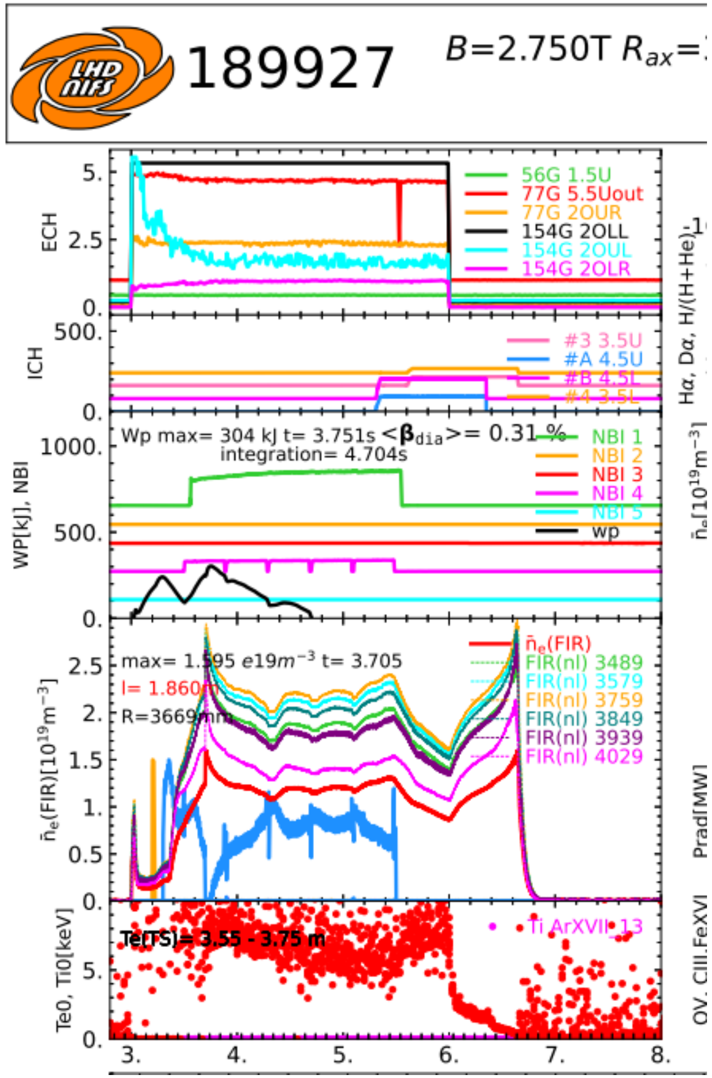
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.254, 100.0%)

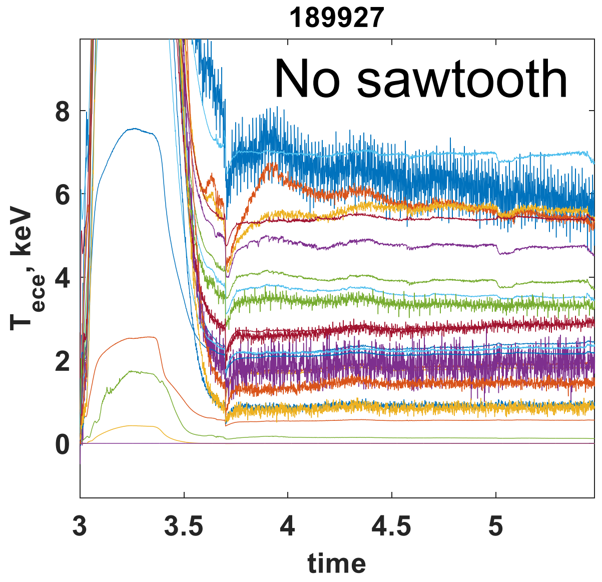
Objective and method:

- Fast ion transport and impurity transport due to sawtooth crashes
- FI sources: NBI1,4,5. Impurity sources (F, Fe, W) - TESPEL

Results:

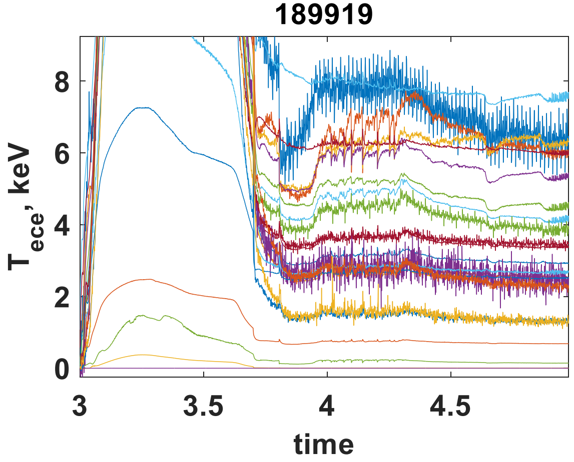
- In comparison with H plasma, it is difficult to produce sawteeth
- The appearance of sawteeth is not reproducible in seemingly similar experimental conditions
- No clear sign of F redistribution due to the crash – evacuated too quickly
- Awaiting for Fe data
- More analysis needed





Similar plasma params

sawtooth



3-ion ICRF heating scheme on impurity

Experimental conditions:

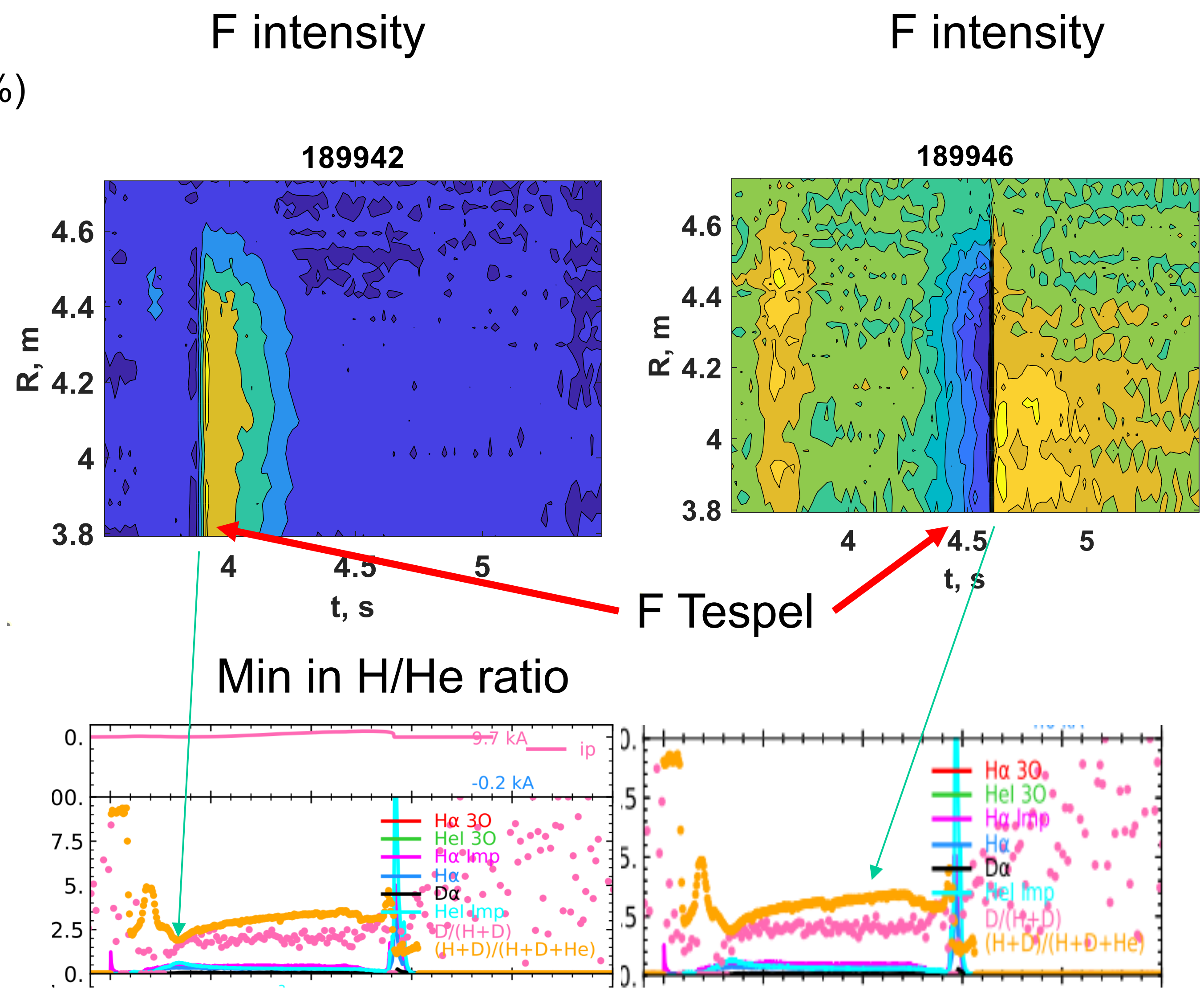
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.68 T, 1.254, 100.0%)

Objective and method:

- Impurity pump-out by 3-ion heating scheme ICRF (2nd harmonic)
- Needs low density of H

Results:

- There is a visible effect
- Has to be checked for other possible explanations before reaching positive conclusions
- Plasma had too large H density
- Was difficult to vary H/He ratio



(SG2) Turbulence & Confinement group report

Apr. 23, 2024 (T. Kobayashi)

Date: Apr. 19, 2024
Time: 14:30 – 16:45
Shot#: 189970 – 190006 (37 shots)
Prior wall conditioning: Yes (He)
Divertor pump: No
Gas puff: Ar, He

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(4.4, -, -, 3.1, -)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, 0.71)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.71, 0.89, 0.98)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.60, -, 0.62, 0.70)MW

Topics

1. Investigation of electron-scale turbulence characteristics and its influence to transport (T. Nasu)
2. Comparison of turbulence driven transport between LHD and W7-X (H. Sakai)

Investigation of electron-scale turbulence and its influence to transport

Proponent: Tatsuhiro Nasu, Tokihiko Tokuzawa, Motoki Nakata

Background: We have investigated electron-scale turbulence characteristics because its influence to transport is not ignorable in high T_e plasma. Especially, we observed their intensity dependence on R_{ax}/L_{Te} in D plasma with constant T_e/T_i in 24th LHD experimental campaign. To investigate the difference in the characteristics when Z_{eff} is changed, we tried to observe intensity dependence on R_{ax}/L_{Te} in He plasma.

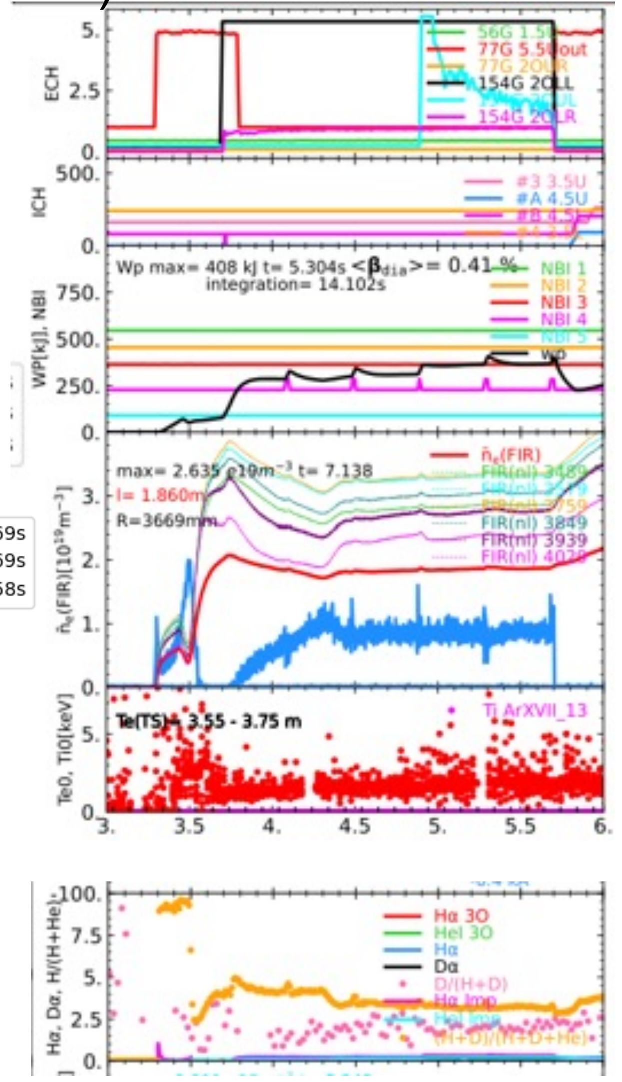
Experimental conditions:

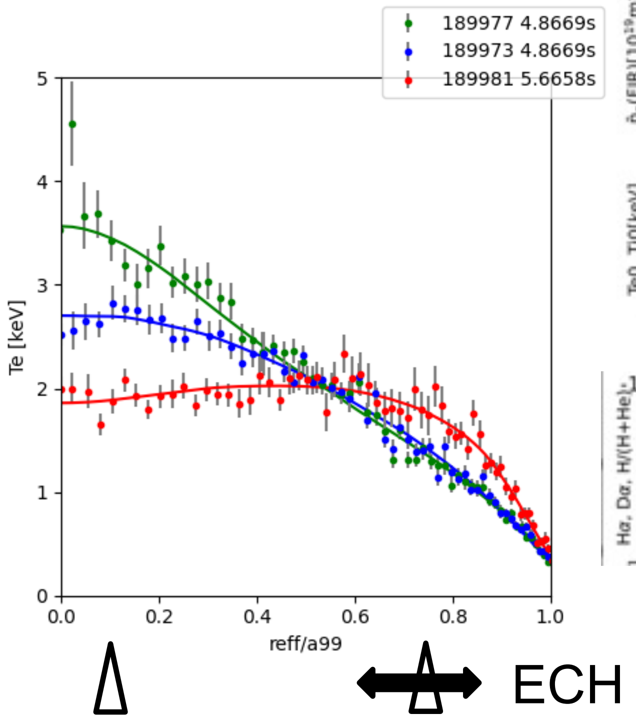
- (R_{ax}, B_t, polarity, gamma, B_q) = (3.6, 2.75, CW, 1.2538, 100), gas: He

Results:

- On-/off-axis ECHs were used to control Te profile with control of power and deposition location.
- He/(H+He) ~ 0.6 should be sufficient purity to observe any difference in electro-scale turbulence intensity.
- We successfully observed wide variety of Te profiles, which have different ∇Te with constant Te at reff/a99~0.5.
  - Ti and ne profiles are almost unchanged then.
- We could observe electron-scale turbulence by BS measurement at reff/a99~0.5.

ex) #189981





Comparison of turbulence driven transport between LHD and W7-X (He-case)

H. Sakai (Kyushu Univ.), K. Tanaka

Shot No: #189983~190006 (24 shots)

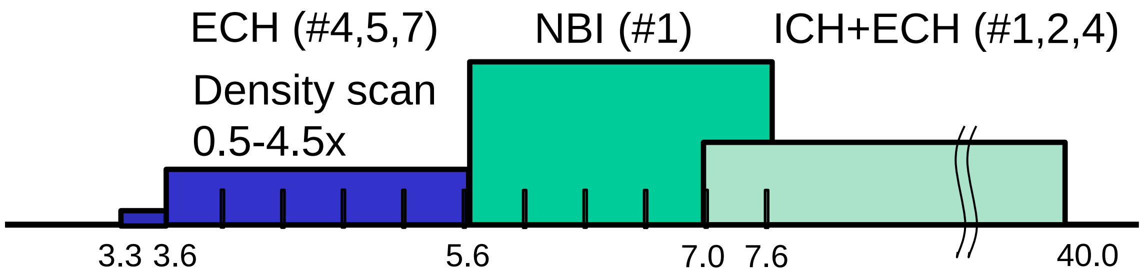
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.2538, 100 %)

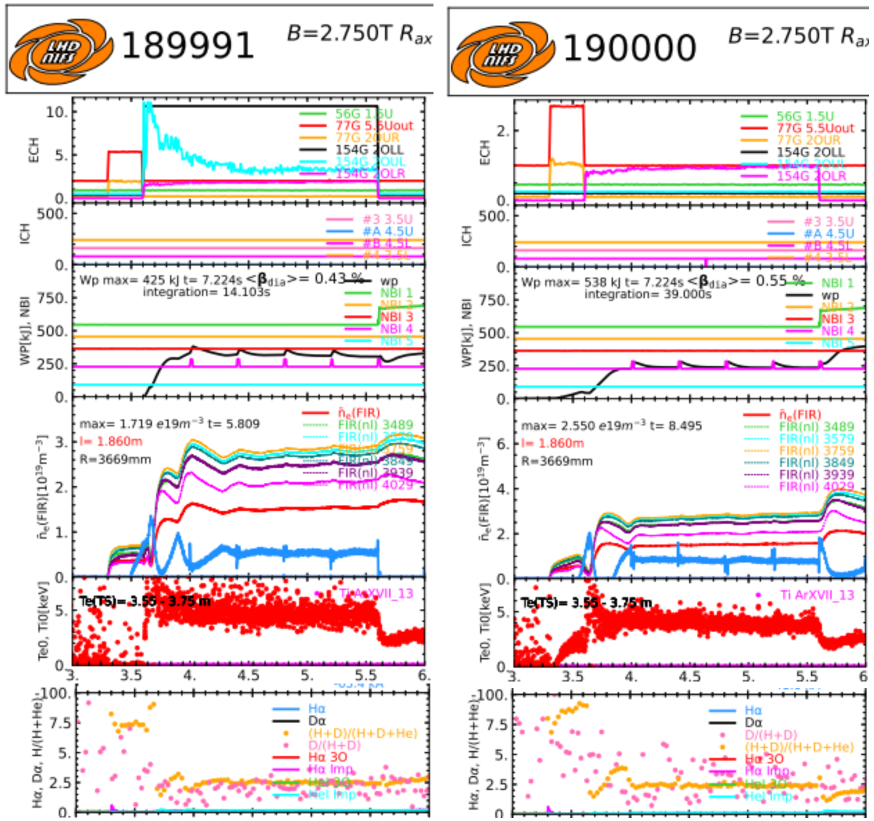
Gas-puff: He

※Experimental sequence was set to 3min +30sec

Approach

To clarify more detail difference in the picture of turbulence driven transport in LHD and W7-X, electron density scan was performed as flat-top with ECH (#4,5,7, ~2MW). Experimental sequence was changed from 3min to 3min+30sec in order to perform discharge cleaning using ICH for high He purity in same shot, because H plasma discharge was conducted all day one day earlier. To sustain ICH plasma, ECH (#1,2,4) was used as long pulse.





Result

- ✓ Unfortunately, ECH#4,5 was very unstable in my time (probably due to using commercial power supply for long pulse ECH). We requested 18 shot combination of short (2sec) and long (40sec) pulse operation. Only four shots were successful. Considering He purity, only one shot (ne~1.5x, He purity~75%) will be useful for comparison between the devices.
- ✓ Same line-averaged density plasma was generated at W7-X, so the comparison of turbulence profile will be performed.