(TG3) Spectroscopy group report

Nov. 23, 2022 (T. Oishi)

Date: Nov. 22, 2022
Time: 9:53 – 18:44
Shot#: 183949 – 184096 (148 shots)
Prior wall conditioning: He GD
Divertor pump: ON
Gas puff: H_2, D_2, He, Ne
Pellet: C (impurity pellet)

NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.2, 3.0, 2.5, 6.0, 5.3)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.703, 0)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.723, 0.799, 0.825)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.8, 0.74, 0.78, 0)MW
Neutron yield integrated over the experiment = 1.2×10^{17}

Topics

1. Diagnosis of fast ions in quiescent plasmas for comparison to predicted neoclassical confinement (W. Hayashi [UCI])
2. Effect of Electron Temperature on Fast-ion Distribution (S. Kamio [UCI])
3. Investigation of impact of ICH on energetic-particle driven instability (Y. Kawachi)
4. Study of edge impurity transport by utilizing multiple spectroscopy diagnostics (T. Nishizawa [Kyushu Univ.])

Diagnosis of fast ions in quiescent plasmas for comparison to predicted neoclassical confinement, W. Hayashi

Background and objective

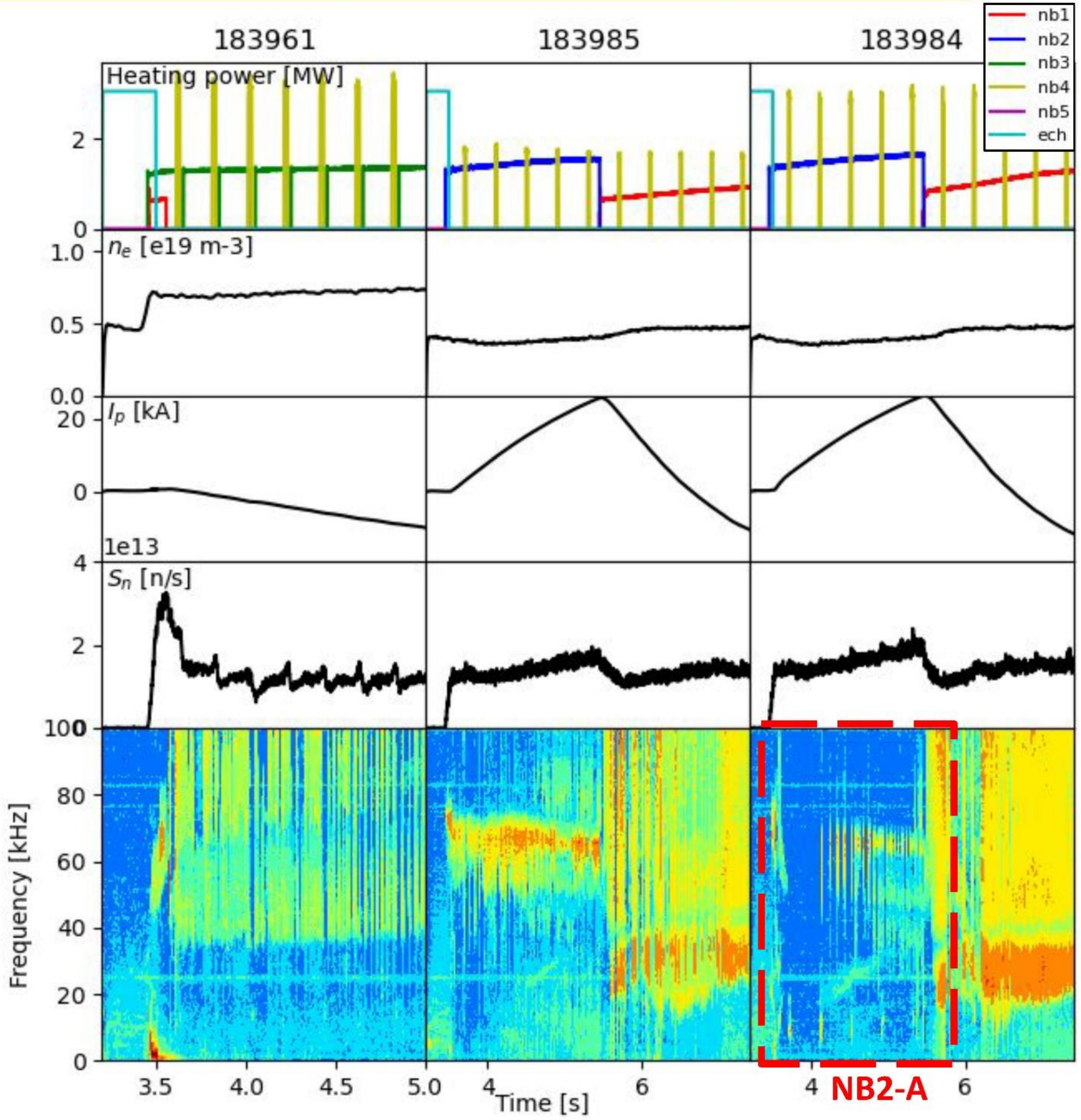
- Continuation of Nov. 17 experiment with a different magnetic configuration
  - "The gyrokinetic code GTC simulates fast-ion transport with neoclassical effects to construct a fast-ion distribution function.
    The synthetic diagnostic code FIDASIM simulates FIDA spectra from a fast-ion distribution function.
    Fast-ion diagnostic data (FIDA, VNC, NPA) for MHD-quiescent plasmas at various magnetic configurations will be compared to simulation."

Experimental condition

- Shots:
  - 183954 – 183989 (Rax=3.90m, Bax=2.5380T)
- ECH startup
- NB3, NB4, NB5 modulation

Results

- Significant difficulty in obtaining a quiescent shot
- NB1 and NB3 produced significant activity
- NB2 produced activity with port B but had reduced activity when using port A
  - For Rax=3.9m, NB2-A is off-axis
- Further analysis of the conditions is required to understand the cause of the instabilities



Effect of Electron Temperature on Fast-ion Distribution

S. Kamio

Shot #:183991-184022

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6, CW, 2.75, 1.2538, 100), NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.0, 2.1, 2.0, 6.1, 0) MW

Background and motivation:

- To understand the effect of the superposition of the electron cyclotron resonance heating (ECH) on the fast ion distribution and transport, measurement of the phase space distribution of fast-ion using the FIDA diagnostic was performed in the MHD-quiescent plasma.

Results:

- We observed the fast-ion distribution with FIDA when ECH power and electron density scanned in the LHD experiment.
- We successfully observed the effect of the T_e on the fast ion distribution. The different responses between high-energy and low-energy range were clearly observed, which indicates the change of transport in phase space. We observed clear dependency also in blue shifted side.

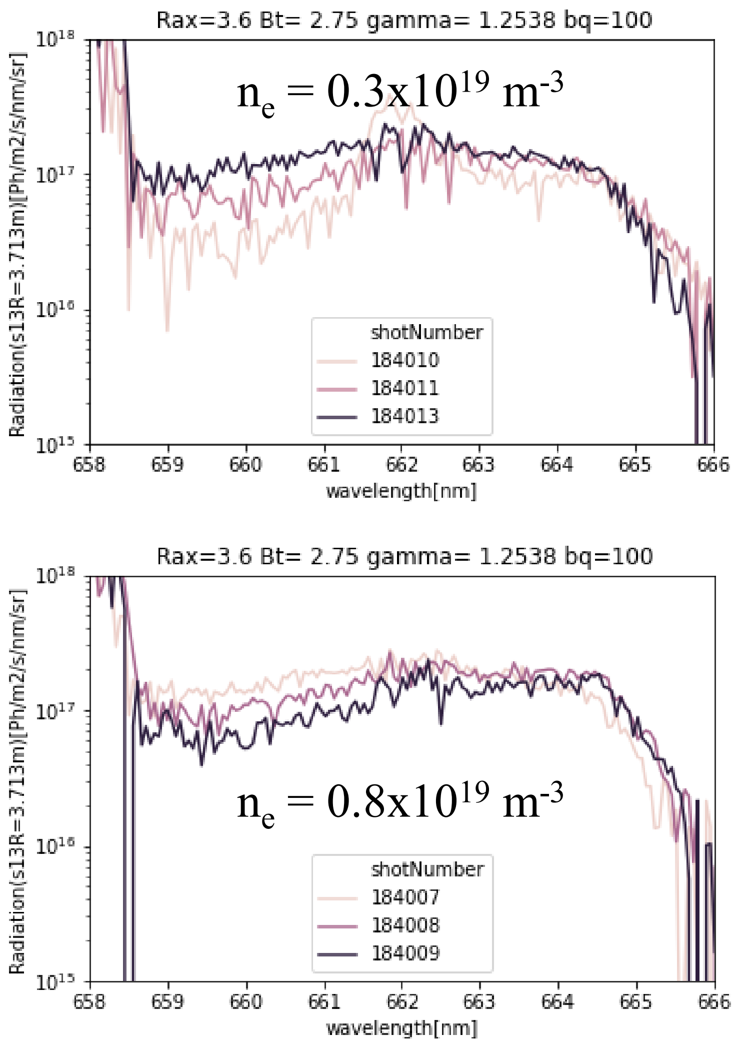


Fig.1 FIDA signals with different T_e in low- and high-density plasma.

Investigation of broadband phase space dynamics from bulk ions to energetic ions in energetic particle driven instability
Investigation of ICH impact on energetic-particle driven instability

Y. Kawachi et al

Shot #: 184023-184061 (total 39 shots)

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

Objective: Simultaneous observation of phase space dynamics of bulk ions and energetic ions during the Tongue/EIC events, and investigation of ICH impact on the Tongue/EIC events.

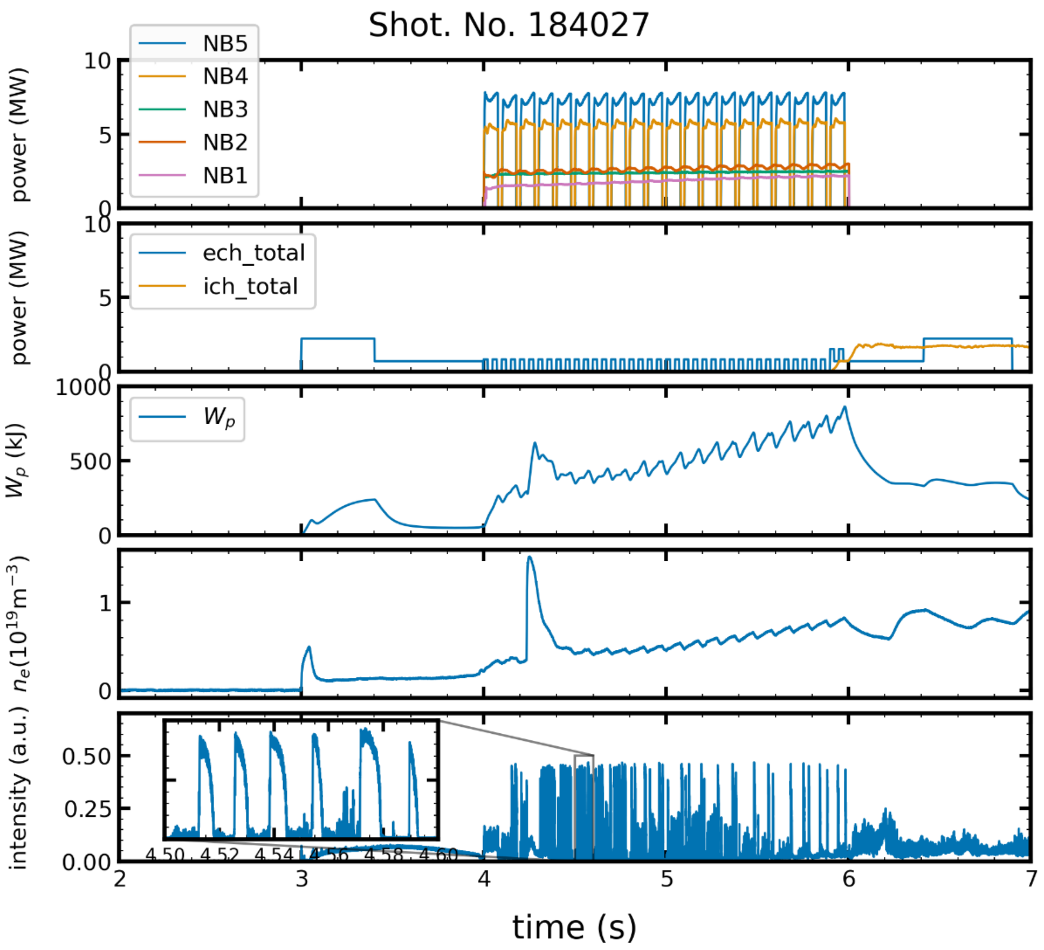
Results:

- The experiment were carried out under the similar condition as the Nov. 17th experiment, only the direction of the magnetic field was changed.
- Some shots include ICH superposition with the events
- Fast-CXS, Fast-FIDA, NPAs measured the phase space dynamics of bulk and energetic ions. CTS did not work because of the Gyrotron trouble.

➢ The Tongue/EIC events appeared reproducibly although the different magnetic field direction.

➢ We obtained dataset of the burst events in low electron density of 0.5-0.8 x 1e19 owing to the previous experiment with He gas puffing and wall conditioning.

➢ HIBP measurement were performed to investigate spatiotemporal dynamics of potential fluctuation associated with the events.



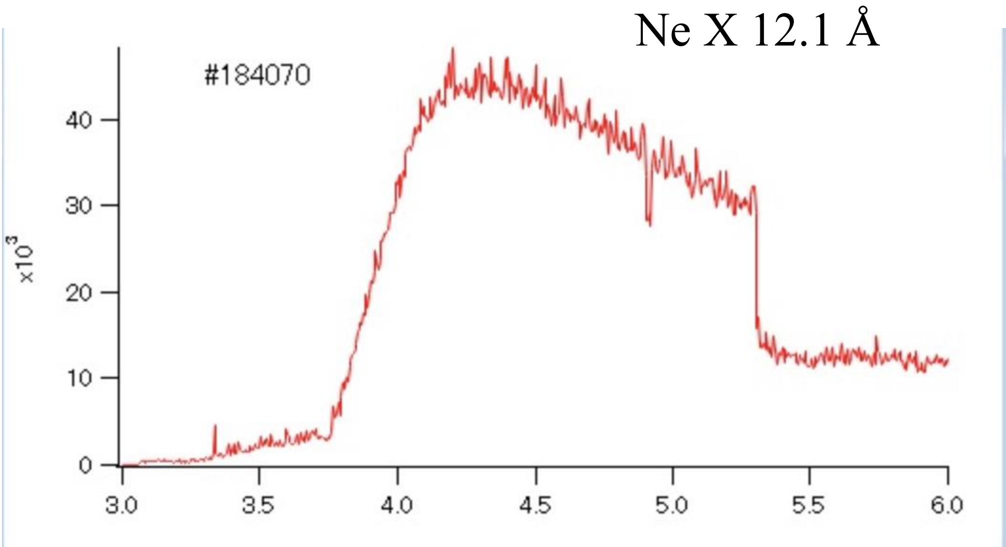
Study of edge impurity transport by utilizing multiple spectroscopic diagnostics
(T. Nishizawa, T. Kobayashi, T. Oishi, Y. Yoshinuma, I. Murakami, D. Kato, and K. Ida)

Shot #: 184065 – 184096

objective: To measure impurity transport coefficients (D and v) just inside the LCFS, characterize isotope effects and heating scheme (hollow vs peaked density profile)

method: Puff Ne for 200 ms and observe Ne emission when the Ne profile is quasi-stationary by using CXR and EUV.
By simultaneously observing multiple charge states of the same impurity species, D and v can be separated without perturbing the impurity profile.

Done: At R_ax=3.6 (m) using deuterium, the density was scanned. The same dataset for hydrogen was already taken on 10/6. Also, a few heating schemes (ECH only vs NBI only, different power, etc..) were performed, and the hollow and peaked density profiles were investigated.



To do: Model atomic processes to obtain impurity profiles, and extract D and v.
Yesterday’s experiments further expands the dataset taken on 10/6. Thorough analysis would reveal the impurity transport properties in the edge region in terms of magnetic configuration, isotope effects, and heating scenarios.