(TG3) Spectroscopy group report

Nov. 3, 2022 (T. Kawate)

Date: Nov. 2, 2022
Time: 9:53 – 11:50, 17:35 - 18:45
Shot#: 182200 – 182231, 182336 - 182357 (54 shots)
Prior wall conditioning: No
Divertor pump: Yes
Gas puff: H_2, D_2, Ar
Pellet: No

NBI#(1, 2, 3, 4, 5)=gas(D, D, H, D, D)=P(2.3, 2.9, 3.9, 6.7, 7.2)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.703, 0.792)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.723, 1.012, 0.986)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0, 0, 0, 0)MW
Neutron yield integrated over the experiment = 1.3×10^{16}

Topics

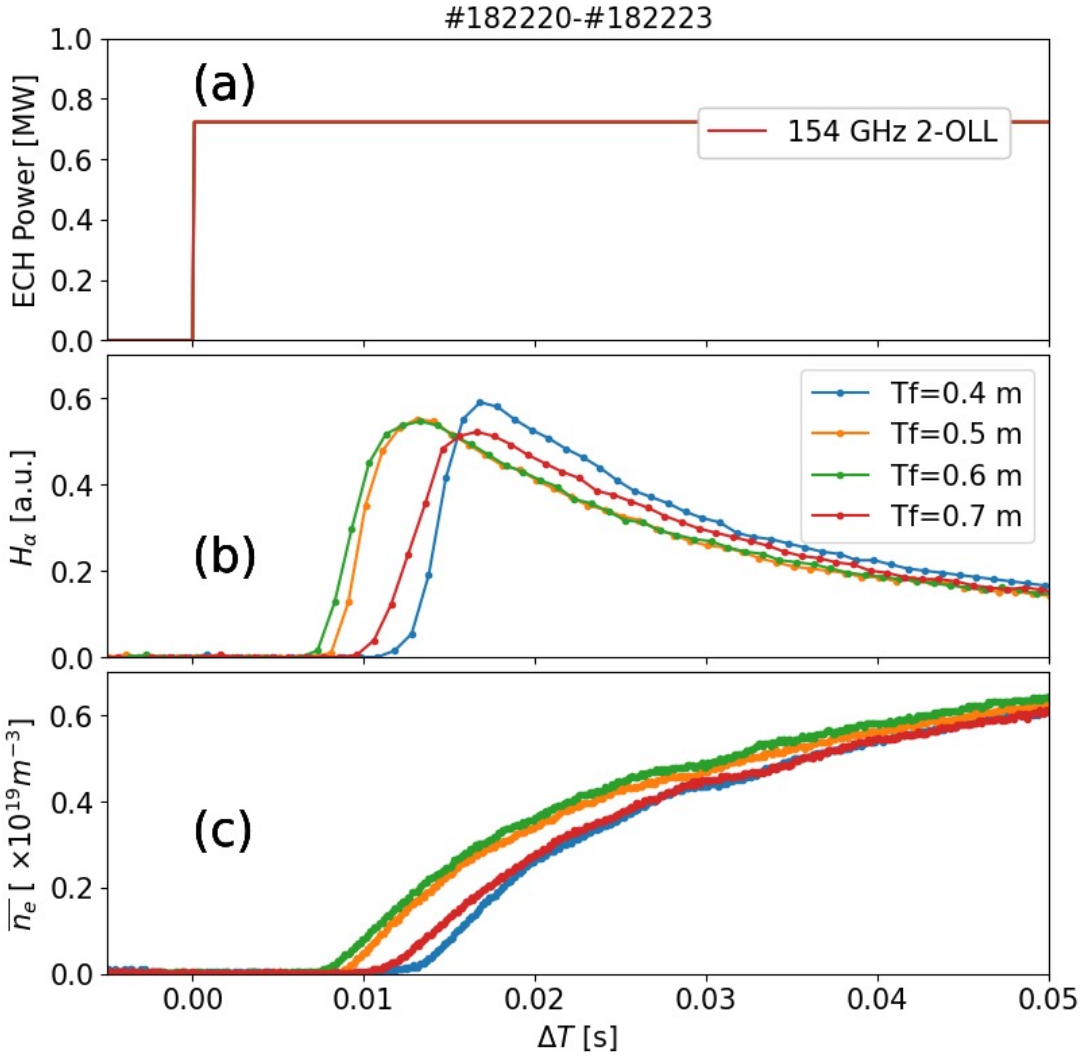
1. Investigation of optimum ECH injection for plasma initiation (R. Yanai)
2. Detection of anisotropic electron velocity distribution via spectral line ratios (T. Kawate)
3. Effect of the anisotropy of the electron velocity on the excitation of the waves from the ion cyclotron to electron cyclotron frequency range via the nonlinear wave-wave coupling (H. Igami)

Optimum ECH injection for plasma initiation (R. Yanai, H. Igami, M. Goto)

Shot #: 182200 – 182231
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100 %)

Motivation and objective:
Scan the toroidal direction and polarization settings of ECH to investigate optimum ECH setting for plasma startup.

Results:
We could scan the toroidal direction of 154 GHz ECH and observe some differences in Hα and electron density rise-up time.
We will check the electron velocity distribution measured by the spectroscopy to investigate what makes these differences.
Unfortunately, we could not obtain the enough data of polarization scan and 77 GHz ECH due to the unstable gyrotron power output because of the first 1 MW gyrotron output trial in this campaign.

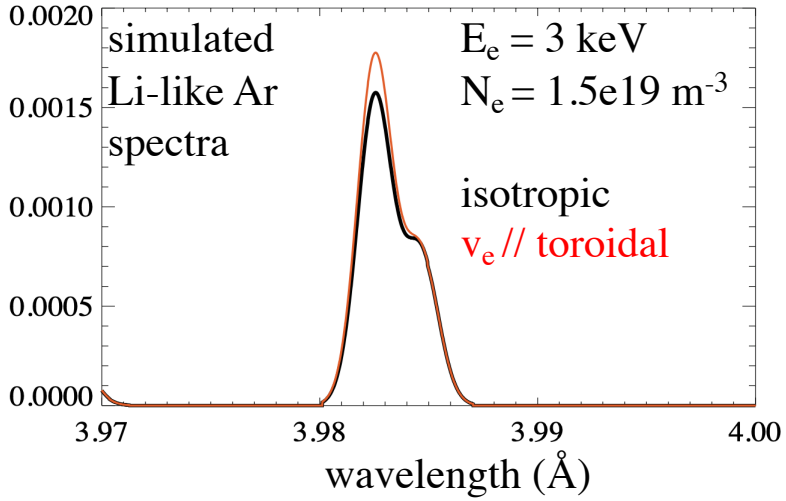


Detection of anisotropic electron velocity distribution via spectral line ratios

T. Kawate et al.

Background:

- X-ray emission lines are routinely observed by the crystal spectrometer, and the reflectivity of the crystal depends on the polarization degree and direction of photons.
- If electron VDF is anisotropic, each emission line shows different polarization signals. Especially, the shape of a bunch of Li-like Ar lines changes.

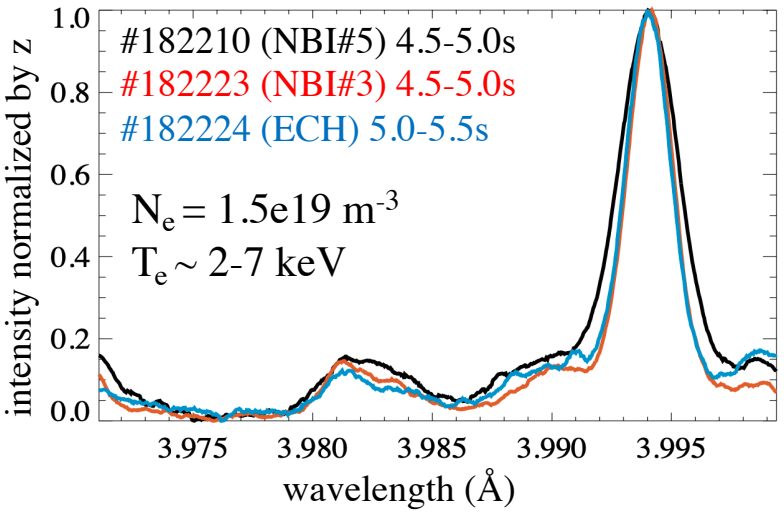


Experimental conditions:

#182200 – 182231, (R_{ax}, B_t, γ, B_q) = (3.6 m, -2.75 T, 1.254, 100%), H_2, Ar gas

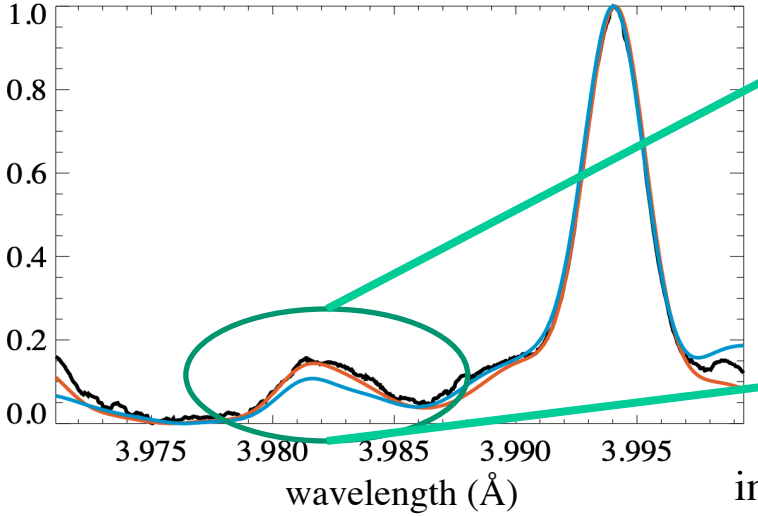
Results:

- spectroscopic data of plasmas sustained by ECH, NBI#3, NBI#5 were obtained.
- plasmas heated by NBI#5 shows wider emission lines (higher T_i)
- simulating the same T_i condition, the shapes of Li-like Ar appear to be different ...?

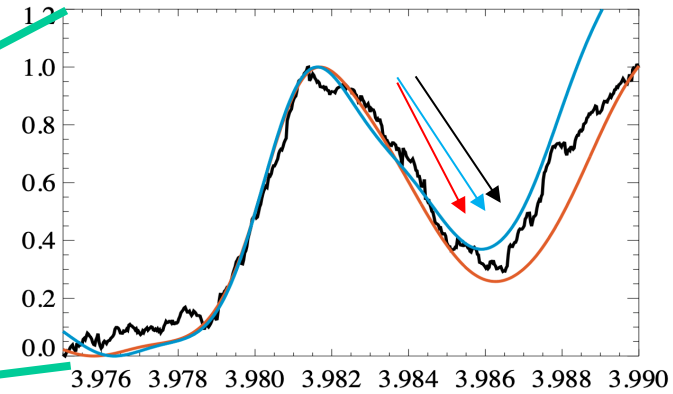


convolve Gaussian

to simulate the same T_i



red (tangential heating) shows steaper(!?)



...need careful analyses including investigation of Ar distribution by EUV data

Effect of the anisotropy of the electron velocity on the excitation of the waves from the ion cyclotron to electron cyclotron frequency range via the nonlinear wave-wave coupling

H. Igami et. al.,

Shot #: 182336 **-** 182357

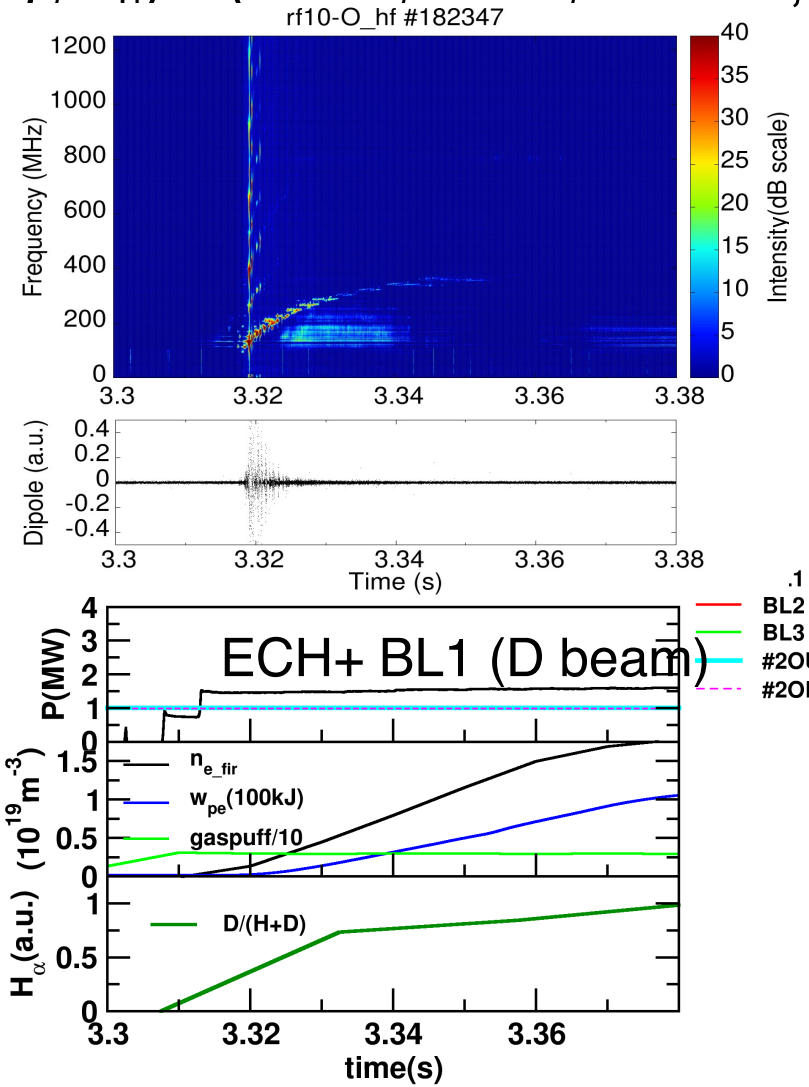
Experimental conditions:(R_{ax}, Polarity, B_t, ν, B_α) = (3.9 m, CCW, 2.538 T, 1.2538, 100.0%)

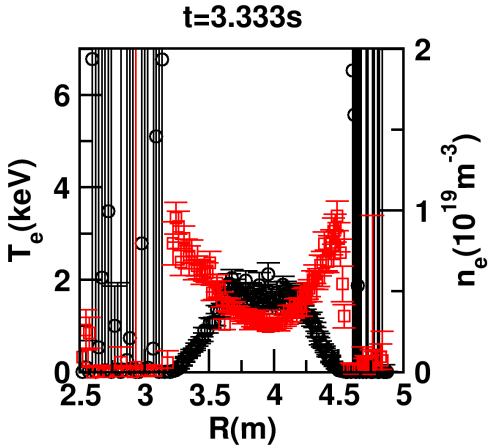
Purpose:

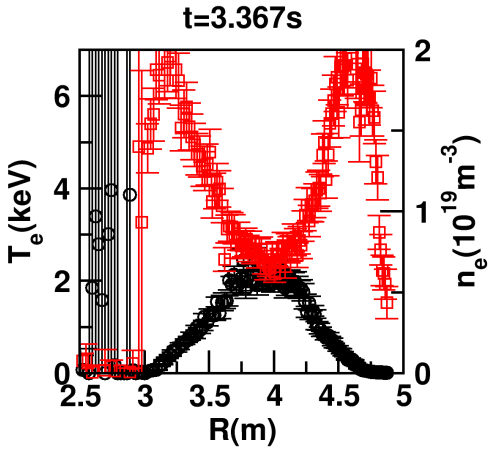
- To investigate the role of the anisotropy of the electron temperature on the wave excitation in the frequency range between the lower hybrid and electron cyclotron wave frequency.

Experimental result:

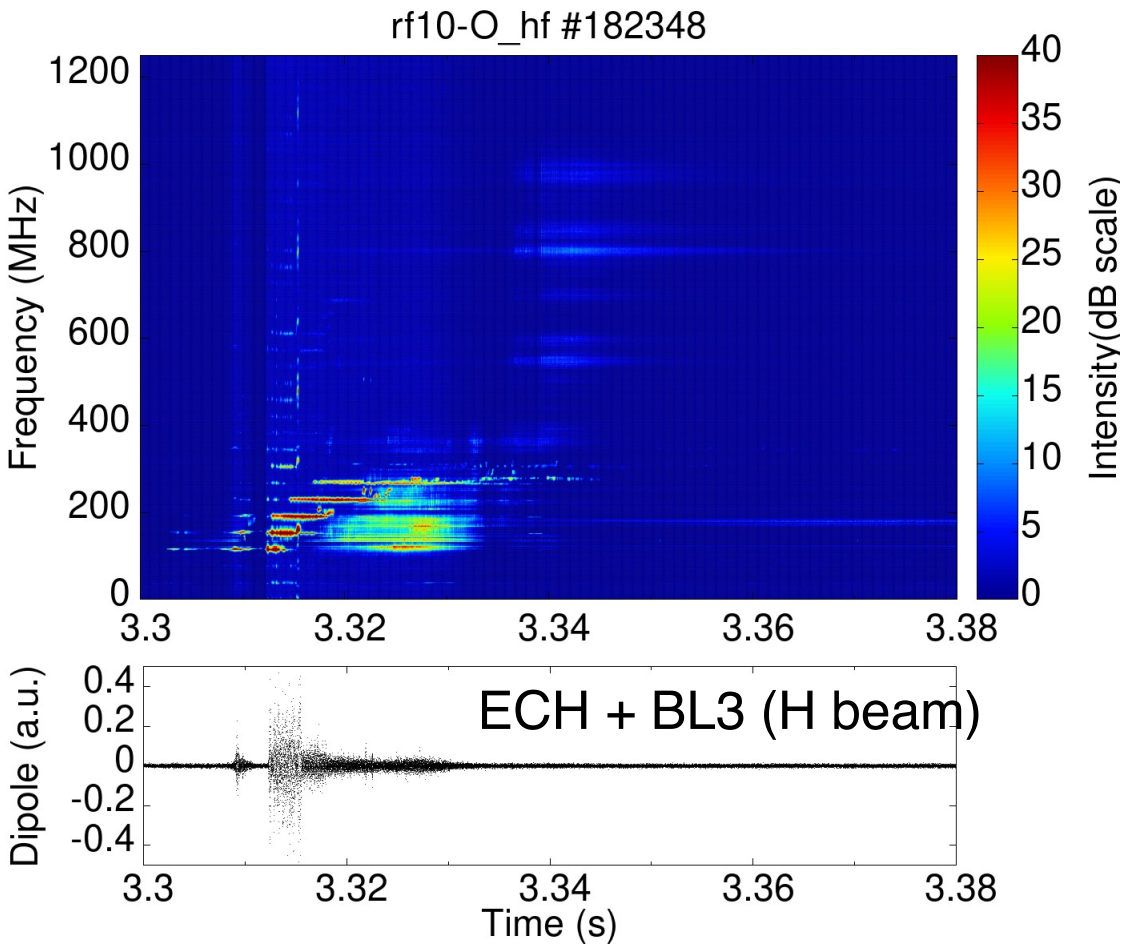
- When n_{e_fir} ~ 0.15 x $10^{19}m^{-3}$, periodic intense frequency peaks were observed with large gap of ~150MHz and small gap which corresponds to the IC frequency

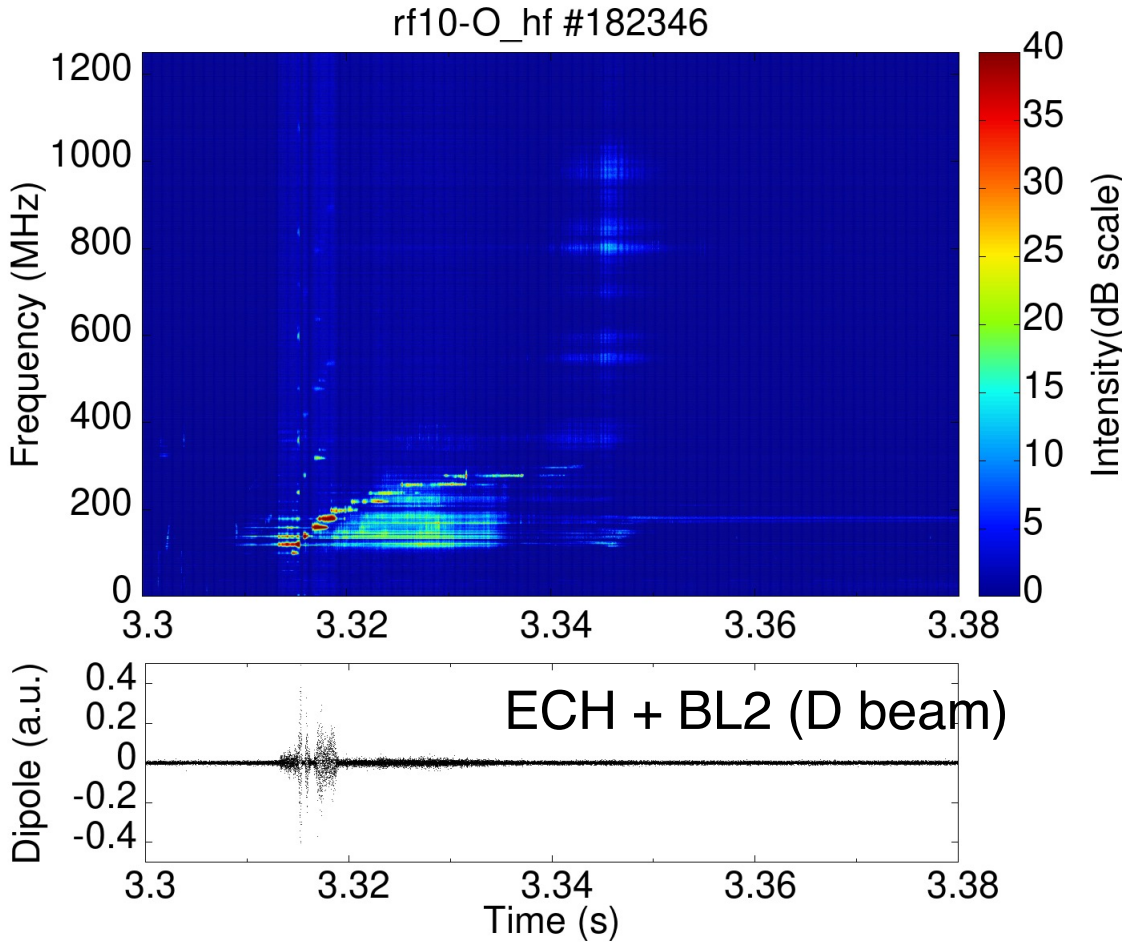






Effect of the anisotropy of the electron velocity on the excitation of the waves from the ion cyclotron to electron cyclotron frequency range via the nonlinear wave-wave coupling





- The small frequency gap corresponds to the IC frequency, ~20MHz for D beam and ~40MHz for H beam
- Thomson forward scattering, polarization-resolved measurements were conducted to investigate the effect of T_e anisotropy on RF wave excitation