Commissioning & (TG3) Spectroscopy Group Report

Date: Oct. 21, 2021
Time: 9:30-12:15, 12:15 – 15:38
Shot#: 170622 - 170670 (91 shots),170671 – 170726 (56 shots)
Prior wall conditioning: NO
Divertor pump: ON
Gas puff: He, H_2, N_2, Ar, Ne

Oct. 22, 2021 (T. Kawate)

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.0, 4.5, 4.0, 5.0, 4.0)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, 0.79)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.46, 0.72, 0.60)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.78, 0.73, 0.82, 0.45)MW
Neutron yield integrated over the experiment = 1.4 x 10^{12}

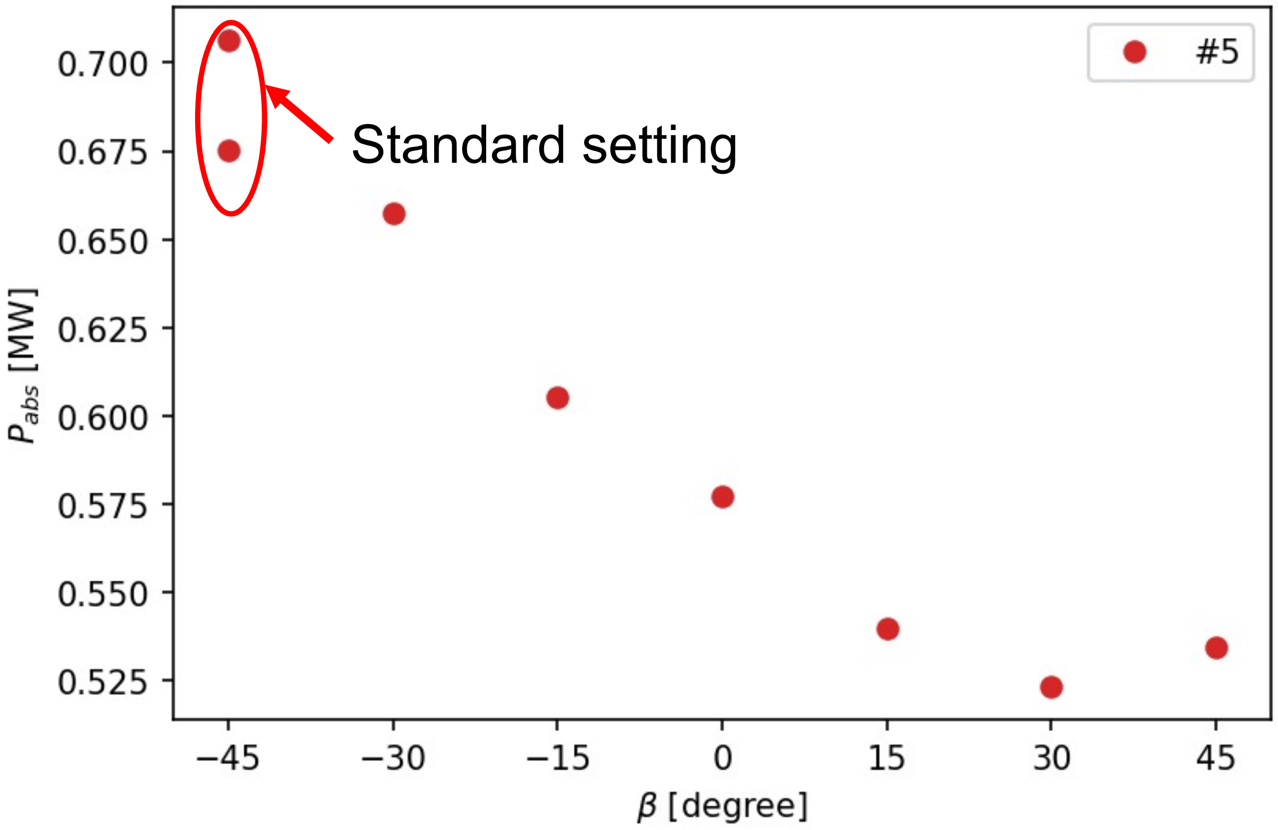
Topics
1. ECH commissioning (R. Yanai)
2. Investigating ECH beam broadening by density fluctuations (R. Yanai)
3. Establishing atomic database of L-shell transitions of the Fe-peak elements with LHD (H. Yamaguchi)
4. Spectroscopic measurement of the time delay between the Ne line emissions at low- and high-ionization states (F. Ding, T. Oishi)
5. Carbon impurity erosion and transport analysis and modelling with ERO2.0 (Romazanov, Shoji)

Experimental conditions: (R_{ax}, B_t, γ, B_q) = (3.6 m, 2.75 T, 1.2538, 100.0%)

Objective: Assessing the polarizer system in the ECH lines.

Method: Scanning the beam polarization:

#5 154 GHz 2-OUL (0.72 MW): α = 0, -45 deg. ≦ β ≦ 45 deg.

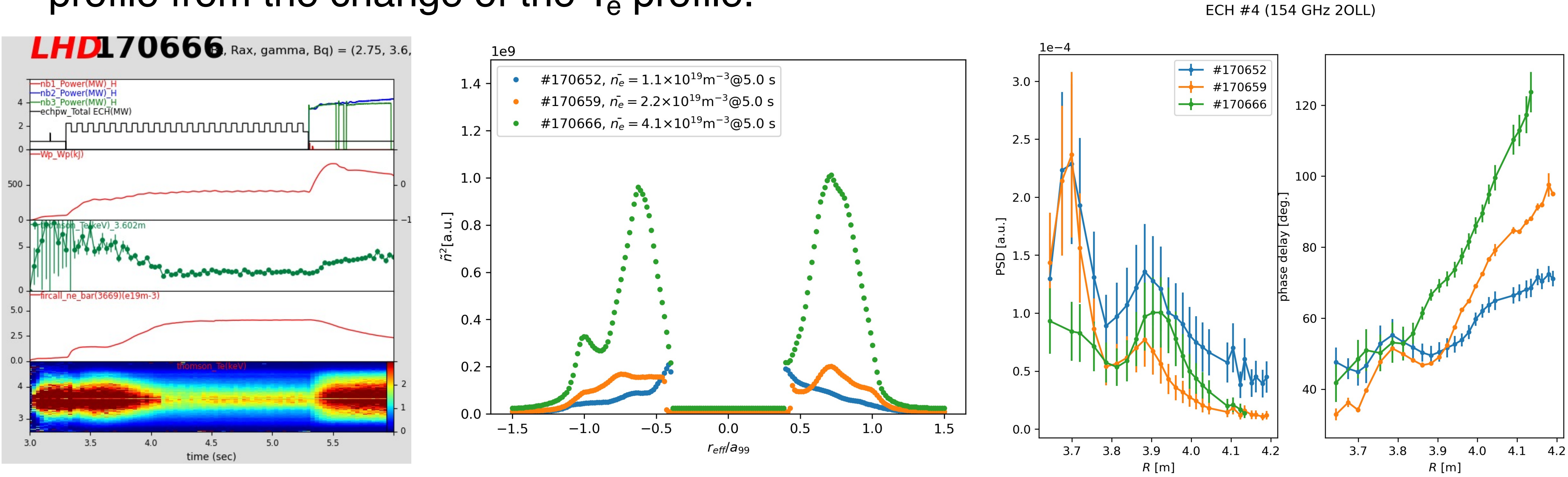


The absorbed power of #5 ECH was estimated using the time derivative of Wp and was maximized at standard setting. The polarizer seems to work properly.

Experimental conditions: (R_{ax}, B_t, γ, B_q) = (3.6 m, 2.75 T, 1.2538, 100.0%)

Objective: Investigating the EC beam scattering caused by density fluctuations.

Method: Using the ECH power modulation and evaluating the power deposition profile from the change of the T_e profile.



The experimental data of some different density fluctuations profiles in different plasma density ranging $1\times19\ \mathrm{m}^{-3}$ to $4\times19\ \mathrm{m}^{-3}$. The detailed analysis will be done to clarify the influence of density fluctuations on the beam broadening.

Establishing atomic database of L-shell transitions of the Fe-peak elements with LHD

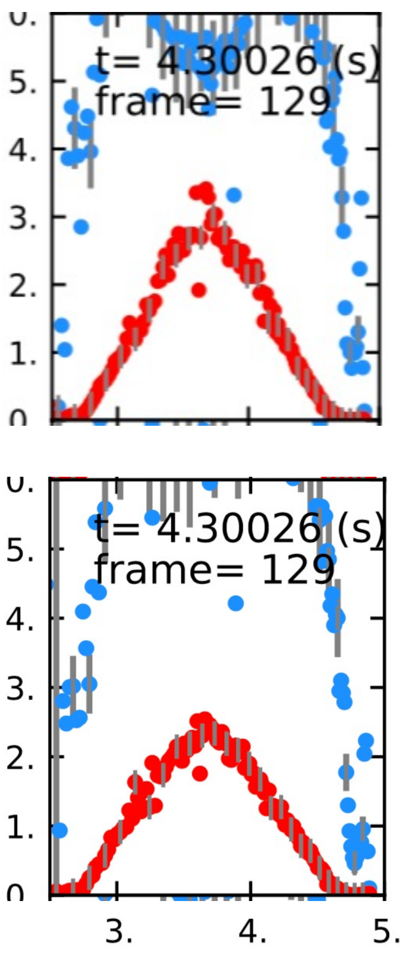
Proponent: H. Yamaguchi, (ISAS/JAXA), Y. Ohshiro (Univ. Tokyo), I. Murakami, T. Kawate, et al. (NIFS)

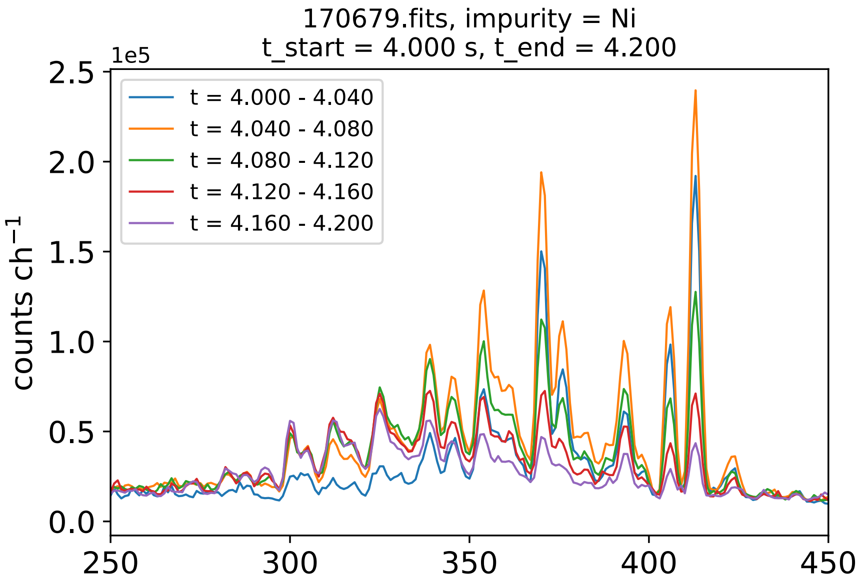
Background: Accurate atomic data are essential for high-resolution spectroscopy in X-ray astronomy. We have conducted the LHD experiment to measure the wavelength and temperature-dependent ion population of Ni and Mn using their L-shell transitions.

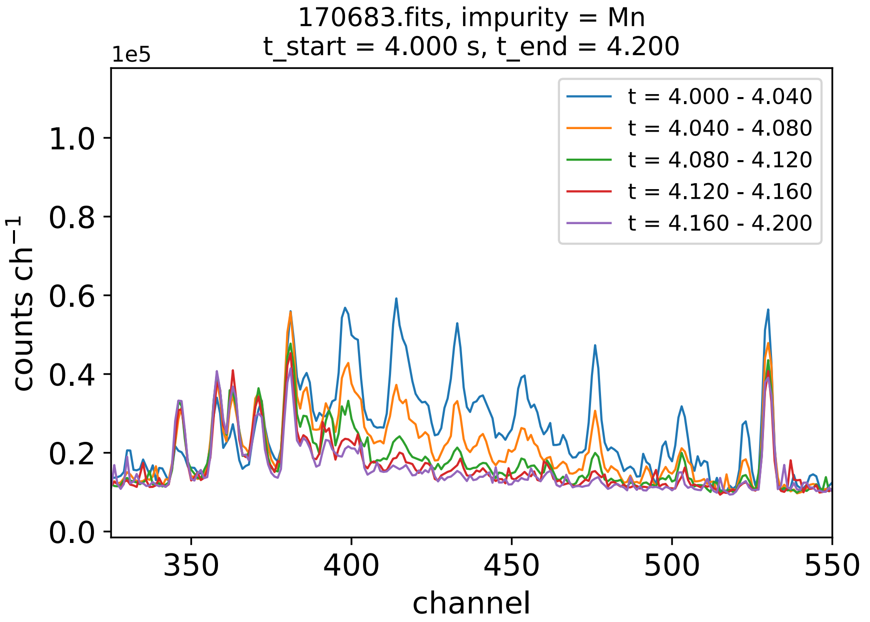
Experimental conditions:

- #170671-170696, NBI #1-#5, ECH H2 gas
- B = 2.75 T, R_{ax} = 3.6 m, γ = 1,2538, B_q = 100%
- Ni impurity pellet or Mn TESPEL was injected at 3.7 or 4.0 s with an electron temperature of 3-5 keV (depending on shot). EUV/soft X-ray spectra at 10-40 Å were measured.

Results: Various emission lines of Ni and Mn were resolved. It was also confirmed that the ion population changed with time due to the variation of the electron temperature. Spatial distribution of ion population is now under investigation.







Oct. 21, 2021
F. Ding (ASIPP)
and T. Oishi

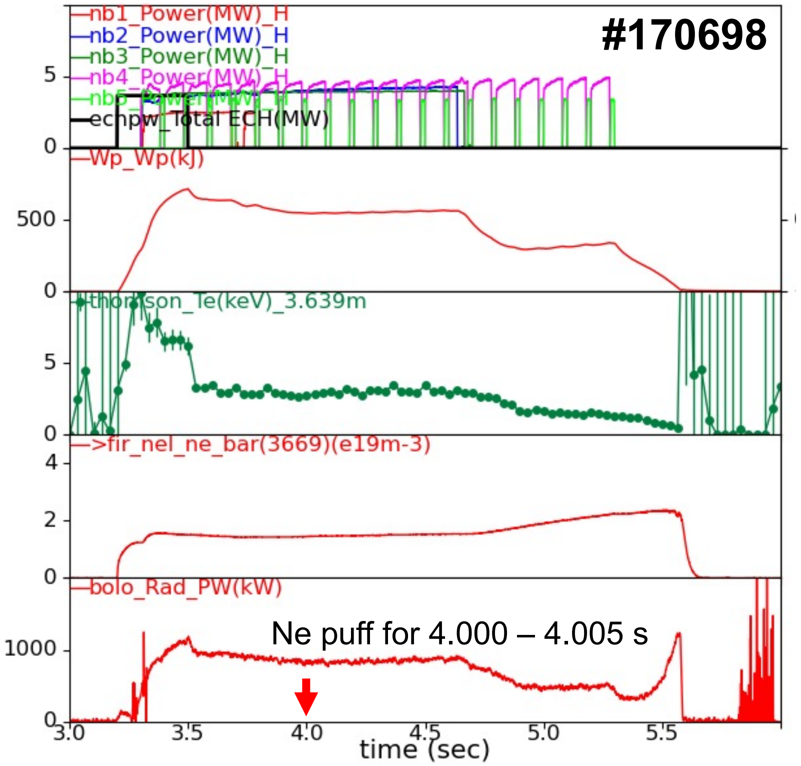
Spectroscopic measurement of the time delay between the Ne line emissions at low- and high-ionization states

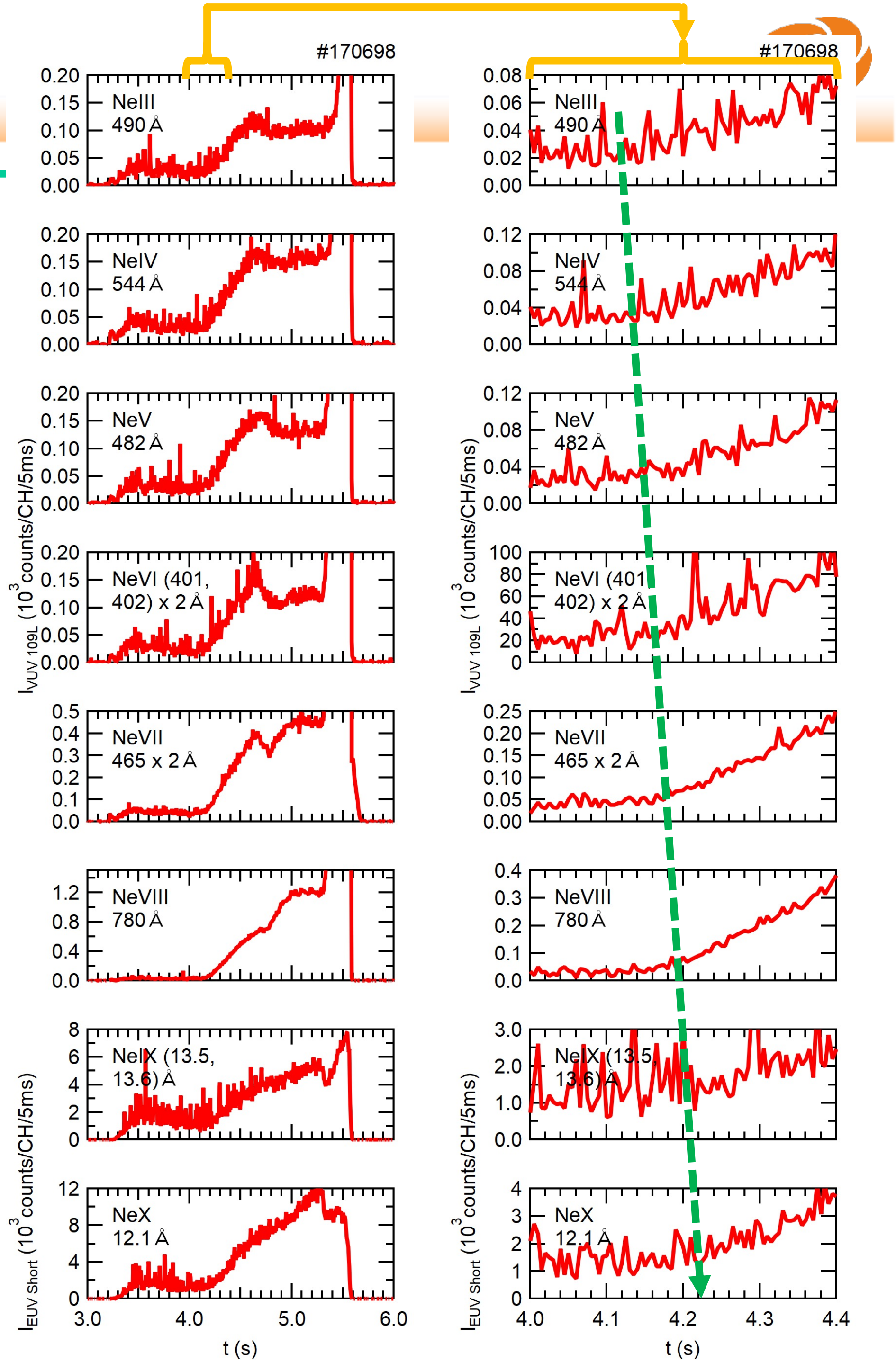
Conditions: R_{ax} = 3.6 m, CW, γ = 1.2538, B_q = 100.0 %
B_t = 2.75 T: #170697-170701, B_t = 1.375 T: #170722-170726 (total 10 shots)

Objective: In order to evaluate the impurity transport characteristics of the edge plasma, Ne impurity gas is injected from the outside and the time delay between the onset of emission of low charge Ne ions and that of high charge Ne ions is investigated.

Results:

- Dataset of n_e scan was obtained.
  B_t = 2.75 T: 1.5 - 10.0 × 10^{13}cm^{-3}
  B_t = 1.375 T: 1.5 - 6.0 × 10^{13}cm^{-3}
- Ne Emission lines of NeIII – NeX were observed simultaneously via the EUV and VUV spectroscopy.
- Qualitative evaluation of the time delay between the onset from NeIII to NeX lines is required to discuss the feasibility of this method to evaluate the impurity transport.





Carbon impurity erosion and transport analysis and modelling with ERO2.0 (J. Romazanov and M. Shoji)

Experimental conditions:

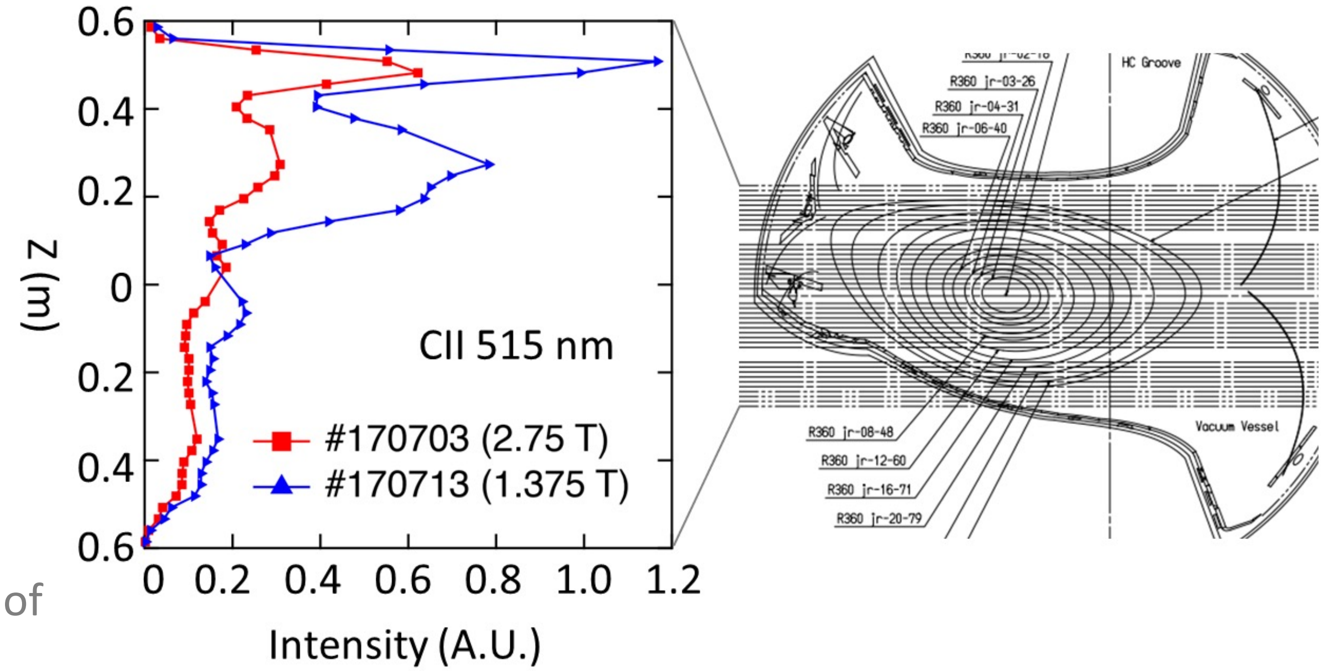
Shot No: #170702 - #170711, R_{ax}=3.60 m, B=2.750 T, $n_{e,\,bar}$=1～7×10^{19} m^{-3}, (Polarity, γ, B_q) = (CW, 1.254, 100.0%)
Shot No: #170712 - #170721, R_{ax}=3.60 m, B=1.375 T, $n_{e,\,bar}$=1～6×10^{19} m^{-3}, NBI: #1,2,3,4 (duration is 2 s), H Plasma

Motivation and objective:

- To collect spectroscopic data on intrinsic carbon impurities for comparison with ERO2.0 simulations
- Improvement of the understanding of erosion and impurity transport, and validation of the ERO2.0 model
- To check the applicability of the implementation of guiding center approximation for carbon impurities for improving the calculation performance of the code

Preliminary results:

- Plasma density was systematically scanned in the range of 1～7×10^{19} m^{-3} and collect the spectroscopic data on carbon impurities in high and low magnetic fields.
- The difference of the Z-axis profile of a carbon intensity (CII) was observed in the high and low magnetic field configurations especially in the positive Z side.
- The structure of the intensity profile around Z=0 m is also different in the two magnetic field configurations.



Z-axis profile of CII intensity for $n_{e,\,bar}$～4×10^{19} m^{-3}

⇨ **The ERO2.0 code will be applied for understanding of the difference of these two observations.**