(TG3) Spectroscopy Topical Group Report

Dec. 8, 2022 (M. Yoshinuma)

Date: Dec. 7, 2022
Time: 15:55-18:45
Shot#: 185362 – 185413 (52 shots)
Prior wall conditioning: H2
Divertor pump: ON
Gas puff: H2, Ar
Pellet: No

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3., 3.9, 3.6, 3.7, 4.3)MW

ECH(77GHz)=ant(5.5-Uout (and 1.5U), 2-OUR)=P(703, -)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(723, 799, 986)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(-)MW
Neutron yield integrated over the experiment = 2.2×10^{13}

Topics

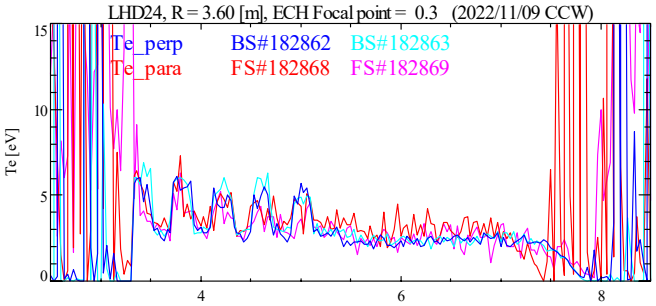
1. Experimental study of the non-Maxwellian distribution of electrons and the electron temperature anisotropy by using the LHD Thomson scattering system (I.Yamada)
2. Diagnostics of relativistic electrons by Thomson scattering in high electron temperature plasmas (H.Funaba)

Non-Maxwellian distributions of electrons
Electron temperature anisotropy
By Thomson scattering diagnostics

2022/12/07
Ichihiro YAMADA
Hisamichi FUNABA

- (R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.75 T, 1.254, 100.0%)
- T_{e0}~7 keV, n_e~1.5 x 10^{19} m^{-3}
- ECH 2.5 Hz modulation and ECH Focal Point
  - 0.0: BS(T_e^{perp}) #185362-67, FS(T_e^{para}) #185381, 82, 83
  - 0.1: BS(T_e^{perp}) #185368, 69, FS(T_e^{para}) #185378, 79, 80
  - 0.3: BS(T_e^{perp}) #185370, 71, FS(T_e^{para}) #185376, 77
  - 0.6: BS(T_e^{perp}) #185372, 73, FS(T_e^{para}) #185374, 75
- We tried the forward scattering measurement to obtain T_e^{para} by Thomson scattering diagnostics, similar to that done on November 9th.

- However, no forward scattering signal was observed yesterday.
- After the experiment, we checked the alignment of the forward scattering laser path, and fixed the misalignment.
- We will try again on December 9th.



Comparison of T_e^{para} and T_e^{perp} measured on November 9th.

- Concerning the search for non-Maxwellian distributions, a detailed analysis is now underway.

Diagnostics of relativistic electrons by Thomson scattering in high electron temperature plasmas

Experimental conditions:

1. (R_{ax}^{VAC}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.85 T, 1.254, 100.0%)
   (# 185384 - #185413)
   ECH power: 3.21MW, NBI#1,2,3 (t = 3.3-5.3s) : 11.0MW

Background and Purposes:

(0) The S/N ratio of the Thomson scattering signals become small in the high T_e and low n_e plasmas. Summation of the signals in some similar plasmas or in the close spatial positions are made on LHD. In order to increase the signal intensity, for example, the multi-pass Thomson system is used in Gamma 10/PDX and the intracavity laser system was used on TEXTOR.

(1) A high repetition rate laser of 1 kHz- 30 pulses or 20 kHz- 100 pulses is available on LHD. In this experiment, it is intended to use this laser for evaluating T_e and n_e in high electron temperature and low density plasmas.

Results:

Low electron density plasmas of $n_e < 5\times10^{18}$ m^{-3} were produced by ECH or NBI + ECH. Fig. 1 shows the comparison of the raw signals and the results of summation of 100 signals of Poly#57 (R = 3.58 m). The Thomson scattering signals appear between the two red dotted lines. It seems that the SNR is improved by this method.

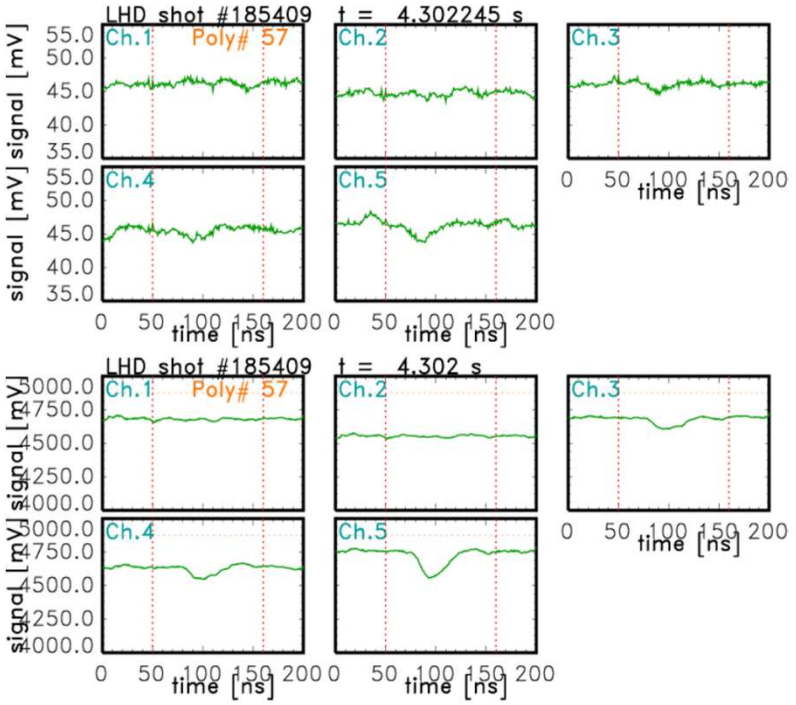


Fig. 1. Thomson scattering signals of 5 spectral channels of Poly#57. Raw signals by one laser pulse are shown in the upper 5 figures. Lower 5 figures show summation of 100 signals in 5 ms.