(TG4) Plasma instability group report

Feb. 2, 2022 (Y. Takemura)

Date: Feb. 1, 2022
Time: 9:45 - 11:45, 14:00 - 15:45
Shot#: 177730 – 177774, 177812 – 177841 (75 shots)

Prior wall conditioning: None
Divertor pump: On
Gas puff: H2, Pellet: No
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(4.9, 1.5, 3.8, 3.6, 4.3)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, 0.79)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.98, 0.93, 0.99)MW
Neutron yield integrated over experiment = (1.1×10^{11})

Topics

1. MHD instability suppression by RMP field (S. Ito, K. Watanabe)
2. Comparative experiments of Bootstrap current in 1/nu and plateau regime in LHD (O. Mitarai, K. Watanabe)

MHD instability suppression by RMP field (S.Ito)

Shot #: 177730-177774
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.75 m, CW, 1.375 T, 1.2538, 100 %)

Background and motivation:

- We want to investigate how the RMP thresholds which can completely suppress instability depend on experimental condition such as β-value, mag. fluc. amplitude and/or mag. field strength without external RMP.
- We conduct the applying RMP experiments fixing an operational mag. field strength (1.375T) and changing the heating power and the operational density.

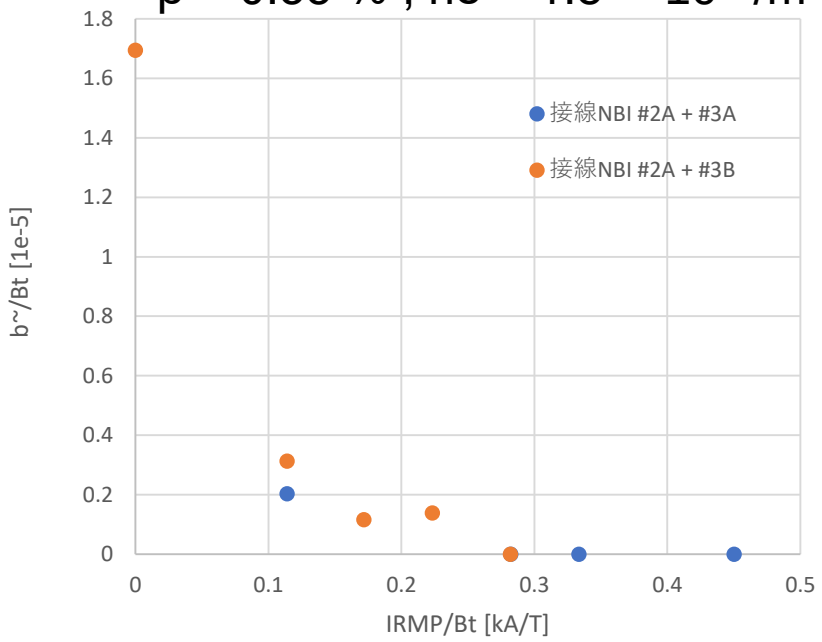
Results:

- In the previous experiment (2021/10/21), we got a result under the condition of β = 1.1 % , ne = 4.4 $\times 10^{19}/m^3$.
  In this experiment, we can get another result under the different heating and density condition.

- As RMP coil current increases, coherent m/n=1/1 mag. fluc. amplitude decreases and finally coherent mode disappears.

- Under this experimental condition of low-β and low-ne, complete instability suppression threshold of external RMP is about 0.25kA/T, which is much smaller than the threshold of previous experiment (0.72kA/T).

β = 0.55 % , ne = 1.8 $\times 10^{19}/m^3$



Comparative experiments of Bootstrap current in 1/ν and plateau regime in LHD

By O.Mitarai (K.Watanabe)

Shot #: 177819-41(177812-5; NBI cond. for long pulse, 177816-8; MSE calib.)
Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.75T, 1.254, 100 %), tang.-NB; bal.-inj.

Background and motivation:

- We have been proposing the high-density operation in the plateau regime for LHD type helical reactor. BS (BootStrap) current is be one of concerns in this fusion reactor.
- Inward-shifted plasma configuration (quasi-omnigenous or σ-optimization) would be used because alpha particle confinement and energy confinement are better. Therefore, BS current in the inward-shifted plasma configuration with R_{ax}=3.6 m would be studied in the 1/ν regime (ν_h^*<~0.5) and the plateau regime (ν_h^*>2~4).
  We expect that the BS current is reduced in the plateau regime.

Results:

- We obtain BS current dependence on beta and collisionality in the relative low-heating power discharges. In high collisional regime, BS current decreases even if beta increases.
- We did not obtain BS current in the low-collisional regime due to a NBI trouble. However, the additional ECH experiment results suggest that BS current increases with the beta in the low-collisional (1/ν) regime.