(TG4) Plasma instability group report

Nov. 17, 2022 (K. Nagaoka)

Date: Nov. 16, 2022
Time: 9:40 - 18:45
Shot#: 183450-183610 (163 shots)

Prior wall conditioning: None
Divertor pump: On
Gas puff: H_2/D_2, Pellet: No
NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.2, 2.2, 2.2, 5.5, 8.7)MW
ECH(56GHz)=ant(1.5-U)=P(0)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.7, 0.8)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.7, 0.8, 0.8)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0, 0, 0, 0)MW
Neutron yield integrated over experiment = (1.6E+17)

Topics
1. ECCD effects on saturated EP profile with AE active regime (K. Nagaoka)
2. Excitation and damping of energetic-particle-driven MHD instabilities by external actuators (K. Nagasaki / K. Nagaoka)
3. Investigation of the beam-beam fusion fraction (H. Nuga)

ECCD effects on saturated EP profile with AE active regime

Shot #: 183450-183610

Experimental conditions:

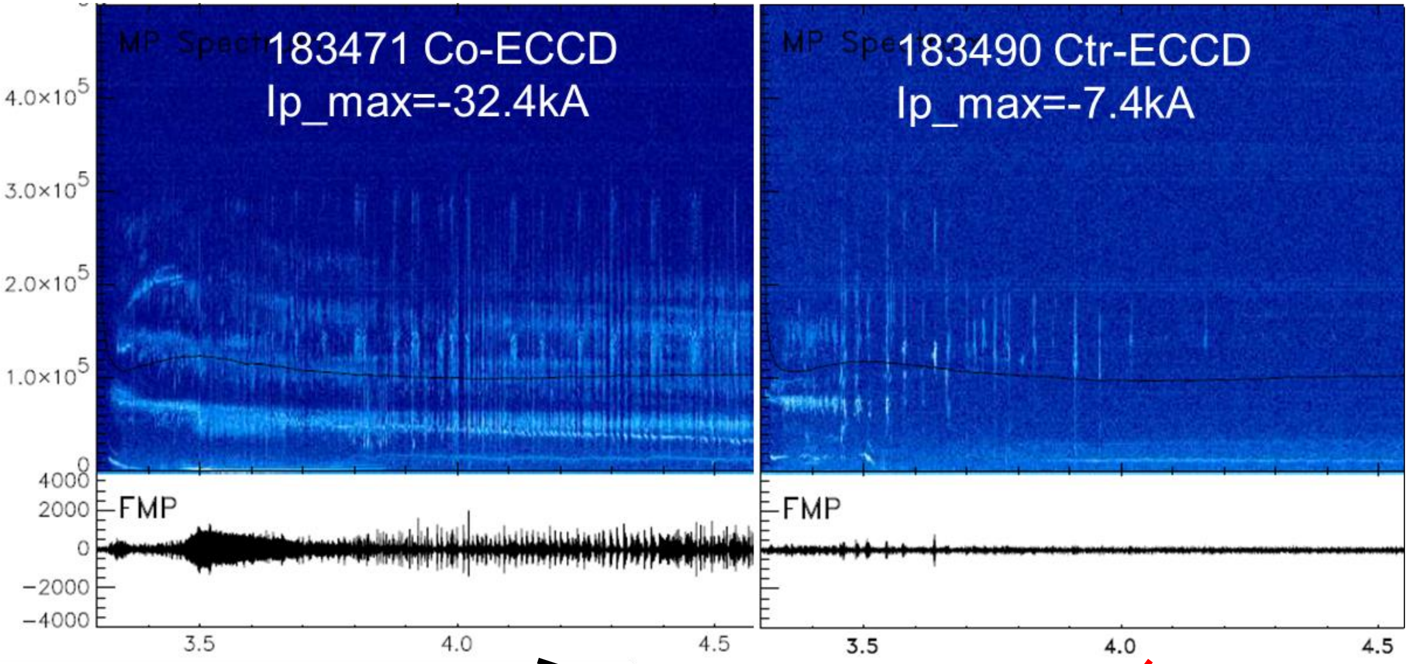
(R_{ax}, Polarity, B_t, γ, B_q) = (3.75, CCW, 1.375, 1.2538, 100)

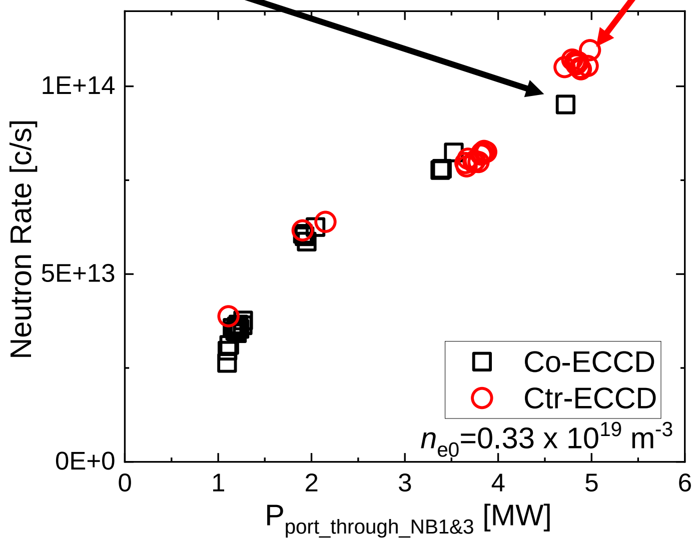
Background and motivation:

- In a previous study, it was found that ECCD may control AEs and resultant EP confinement.
- This experiment is a trial to modify EP confinement with ECCD application in the regime of EP profile saturation.

Results:

- Reproduction of AE stabilization due to Ctr-ECCD was successful.
- The saturation of the neutron rate is mild.
- The difference in neutron emission is slight between Co- and Ctr-ECCD applications.
- The detailed comparison with the previous experiments will be carried out.





Excitation and Damping of Energetic-Particle-Driven MHD Instabilities by External Actuators

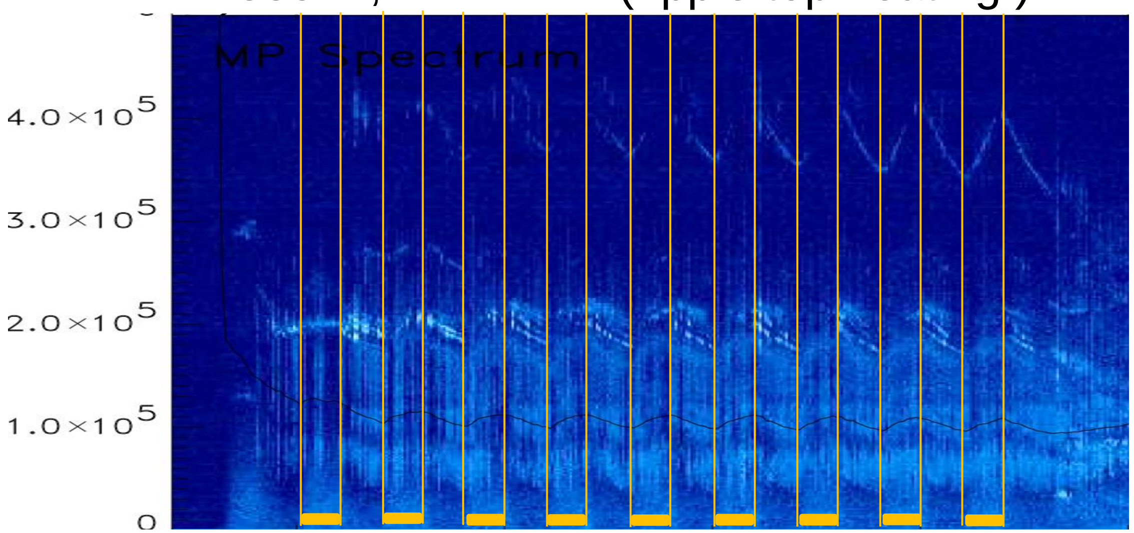
Nagasaki (Kyoto Univ.), Nagaoka, J. Varela (Carlos III Univ.)

Experimental conditions:
Shot numbers: #183498 - #183529
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 1.2538, 100 %)
NBI: #1 (2MW), #2 (2MW) , #3 (2MW)
ECH: 77GHz 5.5U (700kW), 2O (790kW) modulation
1. B=1.277T: ripple top heating
2. B=1.49T: ripple bottom heating

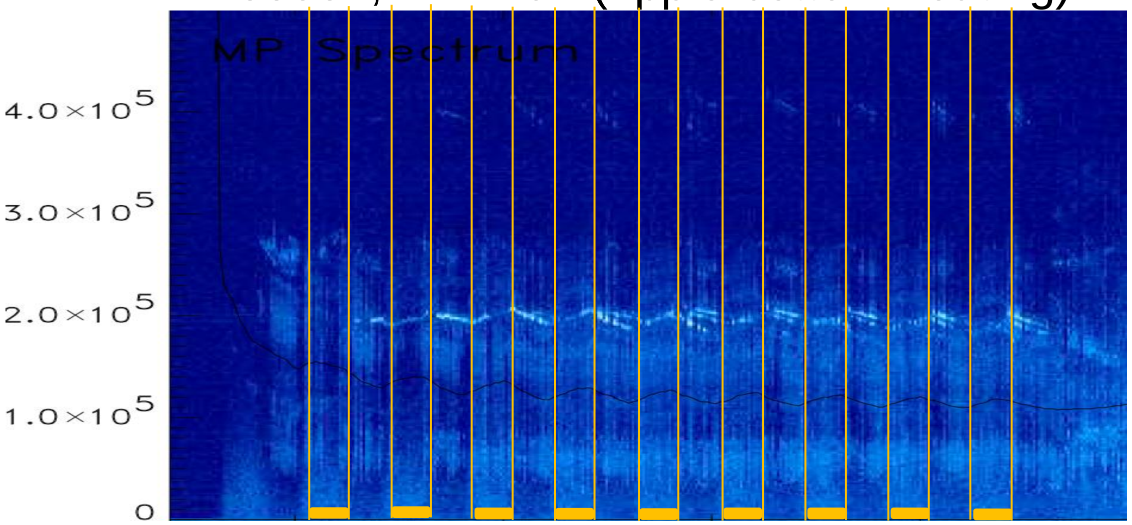
Background and motivation:
- ECH/ECCD is an effective tool to control EP-driven modes
- The population of trapped electrons produced by ECH may affect the damping effect

Results:
- The mode of 200 kHz is more suppressed at ripple top heating at NBI#2 and 5.5U+2O ECH.
- The mode of 50 kHz appeared to be enhanced at ripple top heating at NBI#2 and 5.5U+2O ECH.
- The NBI and ECH power is also scanned

#183512, B=1.277T (ripple top heating)



#183531, B=1.49T (ripple bottom heating)



Investigation of the beam-beam fusion fraction

Shot #: 183566-183610 (45 discharges) H. Nuga

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.254, 100 %)

Background and motivation:

- In LHD, due to the high injection energy (~180 keV) and the high port through power NBI system, the fusion reaction between fast deuterons (bb fusion) is not negligible.
- The estimation of the ratio of the bb fusion is important for EP driven instability studies.
- Because the neutron emission rate is sensitive to the bulk deuteron density, bulk ion prof. measurements are required.
- Aim of this exp. is taking reference data with bulk ion density measurement (DH ratio, HHe ratio, carbon dens.)

Summary:

- Density scan with 3 beam patterns (NB#1+NB#2, NB#1+NB#3, NB#1+NB#5) was performed.
- Density scan range is 0.5e19< ne< 3e19
- bb fusion ratio will be investigated using F-P simulation..