(TG4) Plasma instability group report

Oct. 12, 2022 (Y. Takemura)

Date: Oct. 7, 2022
Time: 9:42 - 13:05, 17:37 - 18:45
Shot#: 180014-180067, 180135-180156 (76 shots)

Prior wall conditioning: Off, Divertor pump: Off
Gas puff: H2, D2, Pellet: No
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.1, 3.5, 0.0, 3.3, 4.8)MW
ECH(56GHz)=ant(1.5-U)=P(0.29)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(0.72, 0.80, 0.83)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0, 0, 0, 0)MW
Neutron yield integrated over experiment = (8.9E+12)

Topics

1. Effect of beta-driven stochastization on edge transport (A. Knieps)
2. Commissioning of optical vortex ECH (T. Tsujimura)
   ※No report due to commissioning, #180057-180066
3. Electron Bernstein wave Emission Measurement during high beta discharge（H. Igami）

Effect of beta-driven stochastization on edge transport

Shot #: 180016 - 180056

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.9m, CCW, 1T, 1.2538, 100)

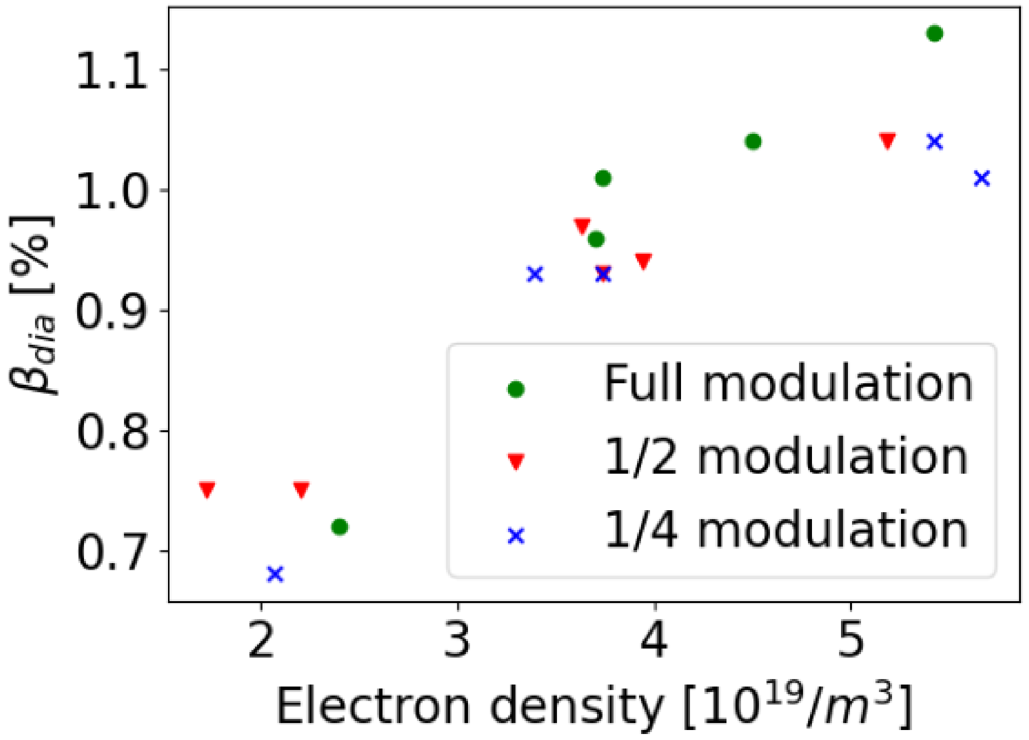
Background and motivation: Aim of this experiment is to study the impact of plasma beta modulation on edge transport. Edge transport is probed by modulating NBI no. 5 and observing response on divertor LPs. Last year's experiment yielded good data sets for 3.6 and 3.75m configuration, but data coverage for 3.9m was poor. This experiment was intended to fill that gap.

Results:

Great coverage of 3D parameter space achieved

- Density: [2 – 5]E19 / m^3
- Modulation power: [1.5 – 6]MW
- Avg. input power: [6.75 – 14]MW

Beta range 0.7% to 1.15% covered



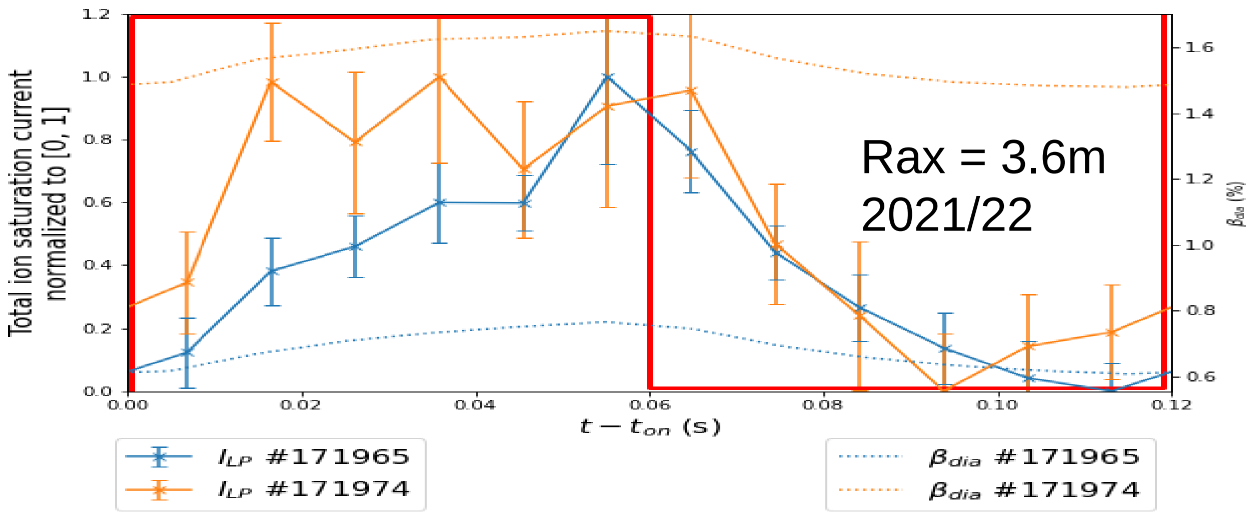
Effect of beta-driven stochastization on edge transport

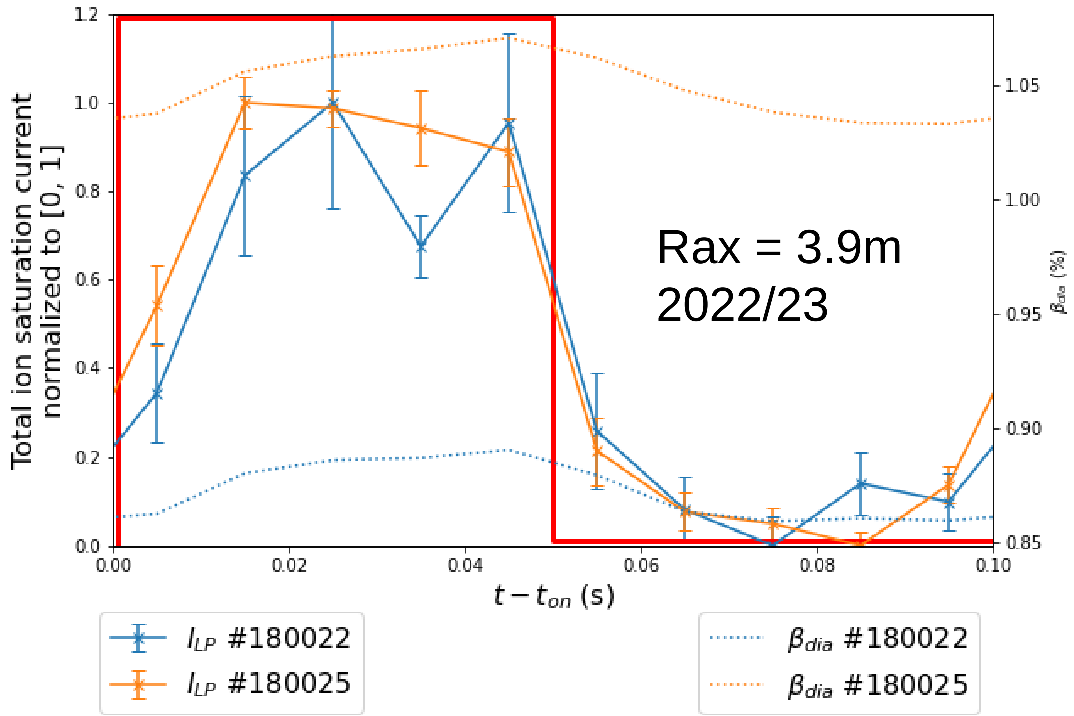
Preliminary analysis result:

Similarly to other configurations, the ion saturation current shows a slightly faster response in the higher-beta cases. However, the low-beta response time is already shorter for Rax = 3.9m.

Open questions:

- Similar to last experiment, difference appears more significant on rising part. Plotting artifact?
- What is the relationship between modulation amplitude and response time? Data are present, analysis is pending.





Effect of beta-driven stochastization on edge transport

Next steps: Interpretative modeling

Target approach: Combine HINT with transport model.

- Option 1: EMC3-EIRENE – Generate grids for different equilibrium configurations and investigate profiles and footprints
- Option 2: Diffusive Monte-Carlo tracing. Sample flight time distributions and impact points to look for effects of changing connection lengths in the plasma edge.

Electron Bernstein wave Emission Measurement during high beta discharge

H. Igami, K. Nagasaki, et. al.,

Shot #: 180134 -180155

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.56, CW, 1.0, 1.2538, 100)

Background and motivation:

- In the over-dense plasma, the thermally emitted waves in the electron cyclotron frequency range propagate as the electrostatic electron Bernstein wave (EBW) and detected as electromagnetic wave via the B-X-O mode conversion process
- The detection of emission originated from EBW in the "over-dense" plasma is expected for T_e measurement

Results:

- Emission was detected by Ka-band radiometer during the "over-dense" plasma was sustained
- As the target point of the antenna is apart from the predicted O-X mode conversion window, the detected intensity decreased