(TG4) Plasma instability group report

Date: Oct. 12, 2022

Time: 11:00 - 16:30

Shot#: 180186-180272 (87 shots)

Oct. 13, 2022 (K. Nagaoka)

Prior wall conditioning: D2 glow

Divertor pump: On

Gas puff: H2/D2, Pellet: No

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.9, 3.9, 1.4, 4.0, 0.0)MW

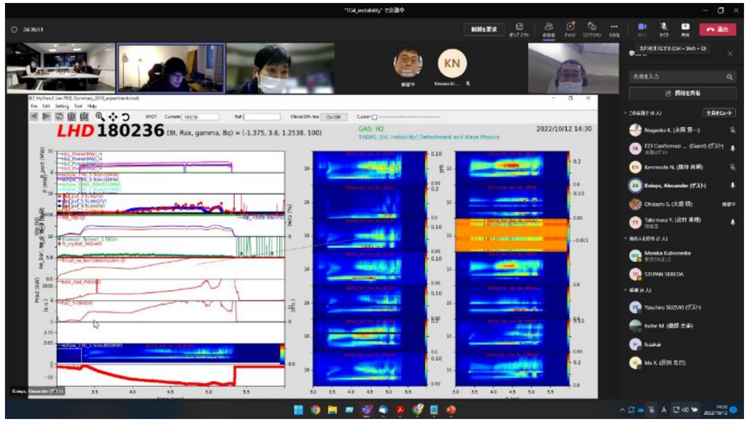
ECH(56GHz)=ant(1.5-U)=P(0.3)MW

ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.7, 0.7)MW

ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.7, 0.7, 0.7)MW

ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0, 0, 0, 0)MW

Neutron yield integrated over experiment = (1.7E+13)



Topics

1. Observation of the electron cyclotron mazer instability in the fusion-oriented plasma, (H. Igami
2. Synergetic effect of 3rd harmonic ECH by 116GHz wave coupled with 2nd harmonic ECH by 77GHz wave, Y. Yoshimura
3. Influence of plasma-beta on intrinsic detachment, A. Knieps/Y. Suzuki (Y. Takemura)

Observation of the electron cyclotron mazer instability in the fusion oriented plasma (H. Igami)

Shot #: 180187-180213

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.60, CCW, 2.75, 1.2538
100), (3.90, CCW, 2.63, 1.2538, 100),

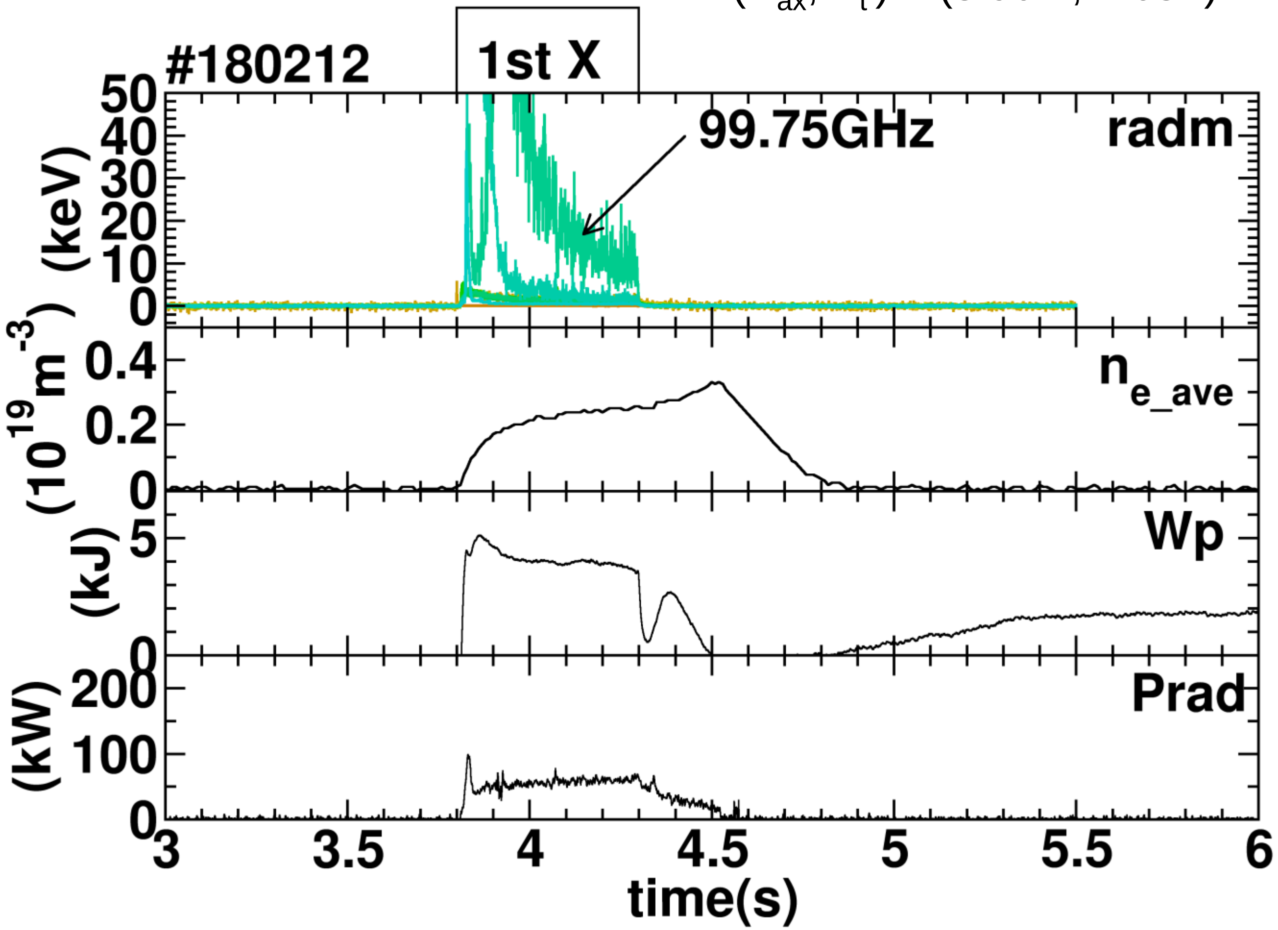
Background and motivation:

- It is thought that the electron cyclotron mazer instability (ECMI) is excited in auroral acceleratec region where the inversion electron velocity distribution is formed
- The motivation is to investigate the effect of ECMIexcitation on the effectiveness of ECRH

Results:

- During the fundamental X-mode injection toward off-axis ECR (ρ~0.8), , very intense non-thermal I was observed at **only 3 channels**.
- Although intensities of the radiation and impurity monitor signals are low, and the density could be started up, the stored energy was very low

(R_{ax}, B_t) = (3.90m, 2.63T)

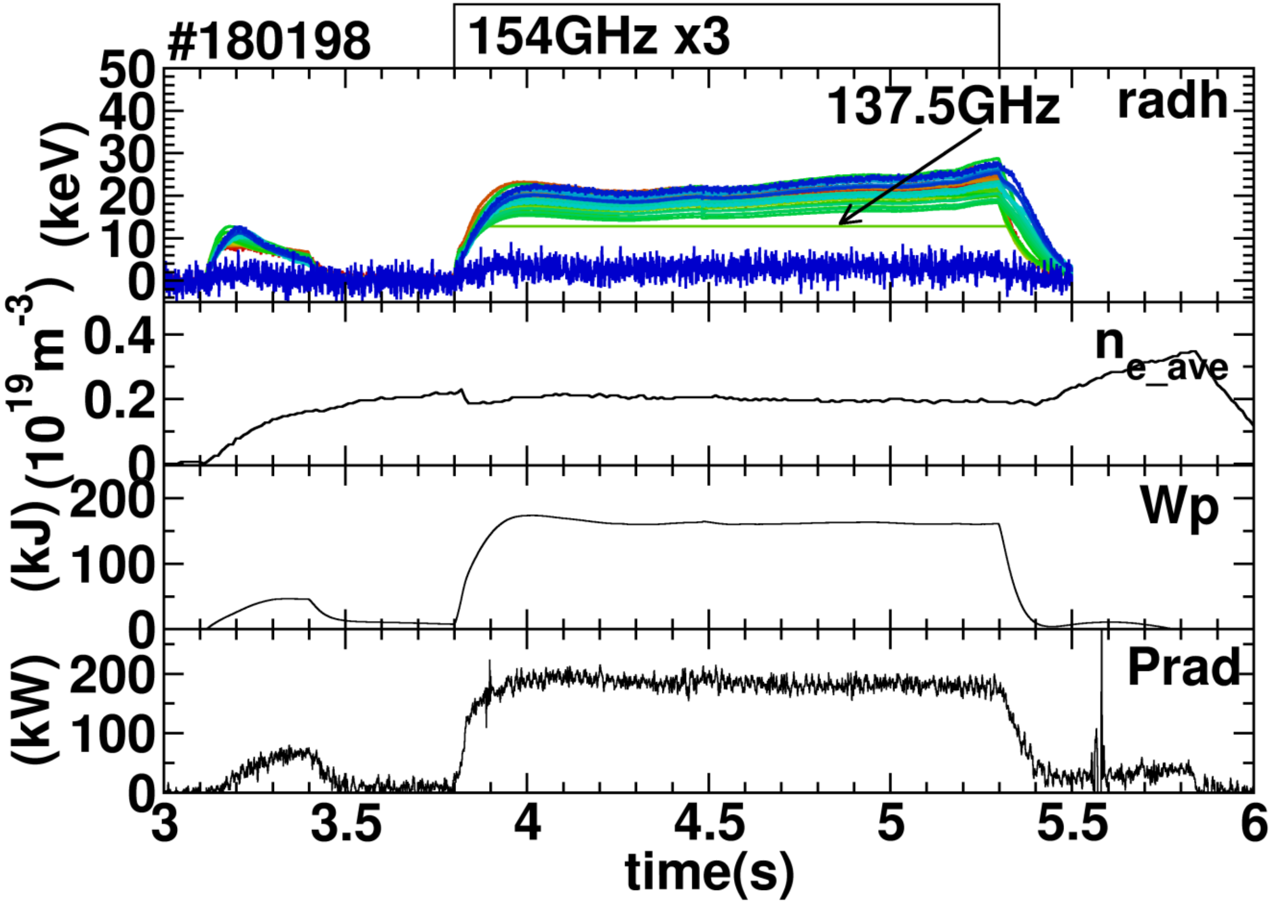


- The injected 1st X-mode power might be transported to non-thermal EC wave radiations

Observation of the electron cyclotron mazer instability in the fusion oriented plasma (H. Igami)

(R_{ax}, B_t) = (3.60m, 2.75T)

- During the 2nd X-mode injection toward the ECR around ρ~0.2 when the magnetic configuration was (R_{ax}, B_t) = (3.60m, 2.75T)
- Very intense non-thermal ECE was observed at 137.5GHz
- The radiation and impurity monitor signals are low



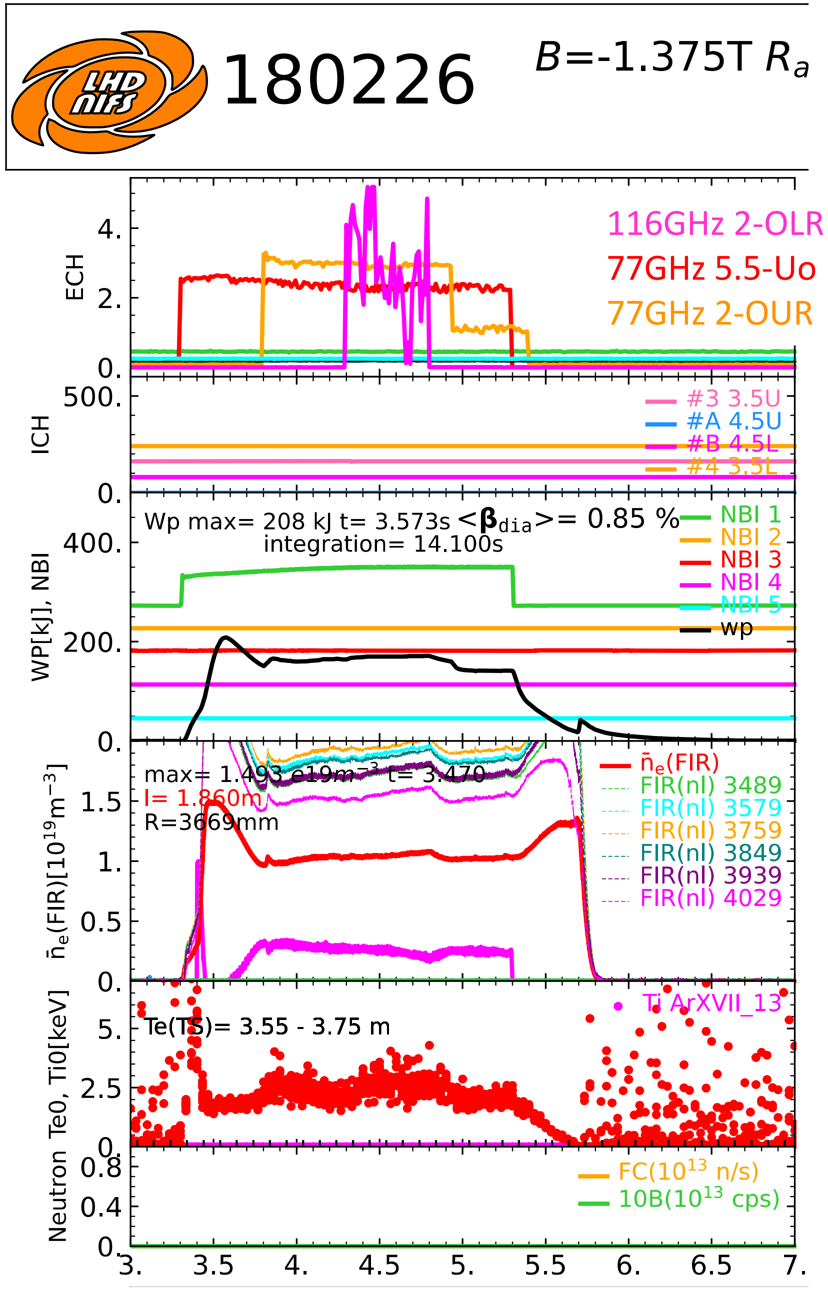
- Precise frequency spectrogram will be investigated with analysis of ECE-U-FAST data

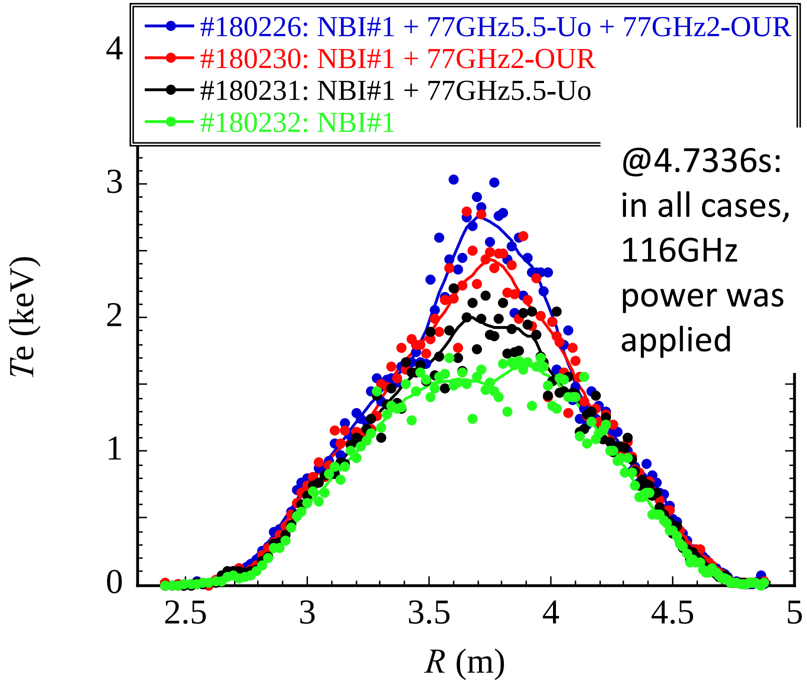
Synergetic effect of 3rd harmonic ECH by 116GHz wave coupled with 2nd harmonic ECH by 77GHz wave (Y. Yoshimura)

Experimental conditions: #180214 - #180232
(Polarity, R_{ax}, B_t, γ, B_q) = (CCW, 3.6 m, 1.375 T, 1.2538, 100%)
ECH Power:
77GHz#1 (5.5-Uo) = 0.703MW
77GHz#2 (2-OUR) = 0.792MW
116GHz (2-OLR) = 0.629MW

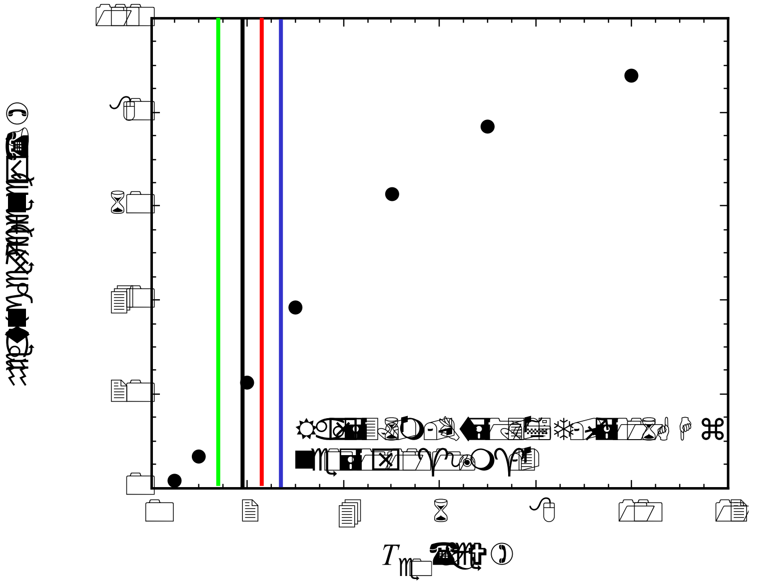
Background and motivation:
154&116GHz dual frequency gyrotron has been available for experiment.
Heating efficiency of 3rd harmonic ECH is expected to be nonlinearly improved by increase in electron temperature.
This nature is investigated by 3rd harm. 116GHz ECH with simultaneously applied 2nd harm. 77GHz ECH.

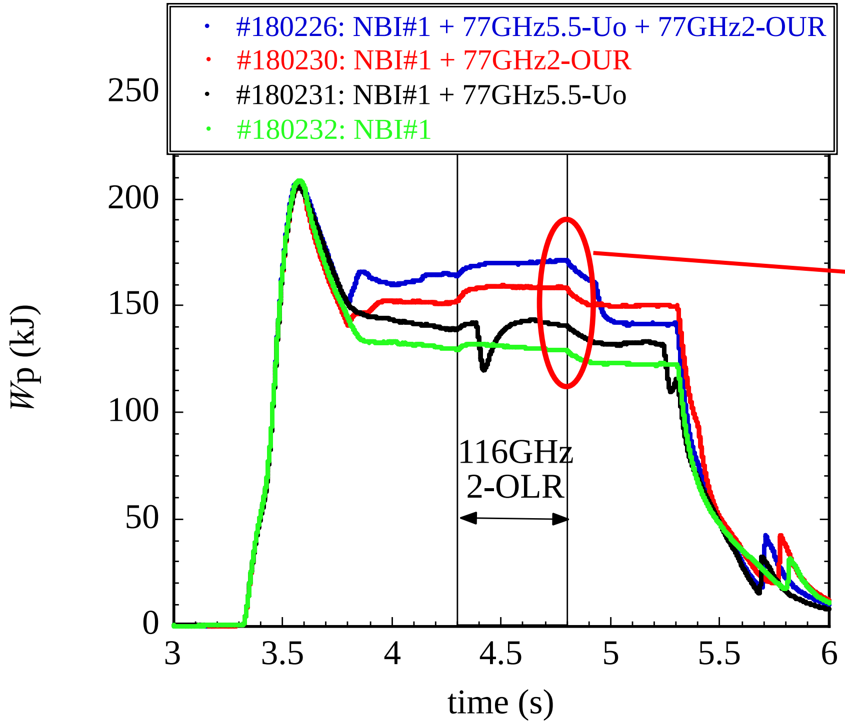
Results:
Heating patterns of
NBI#1 + 116GHz 2-OLR and/or 77GHz 5.5-Uo and/or 77GHz 2-OUR
were performed to vary T_e at n_e = 1x10^{19} m^{-3}.
According to the T_e variation, absorbed power P_{abs} of 3rd harmonic 116GHz ECH evaluated from W_p data increased with T_e.
Experimentally evaluated heating efficiency η_{heat} qualitatively agrees with η_{heat} calculated with TRAVIS code in both of absolute value and dependence on T_e.





Calculated heating efficiency η_{heat}





Experimentally evaluated absorbed power P_{abs} and η_{heat}

P_{abs} = 148kW, η_{heat} = 23.5%

P_{abs} = 122kW, η_{heat} = 19.4%

P_{abs} = 86kW, η_{heat} = 13.7%

P_{abs} = 81kW, η_{heat} = 12.9%

Plasma-beta effect on detachment density threshold (A. Knieps)

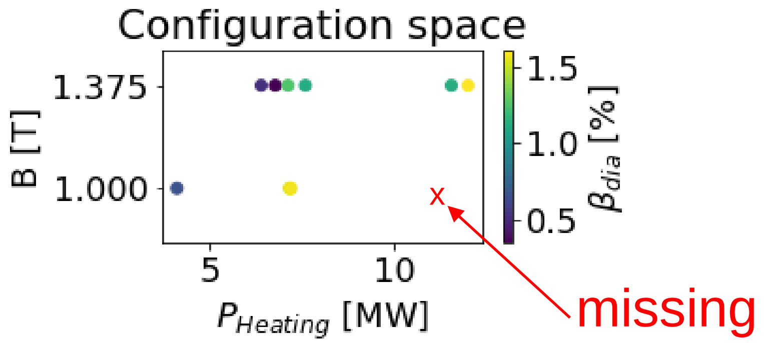
Shot #: 180238 - 180271

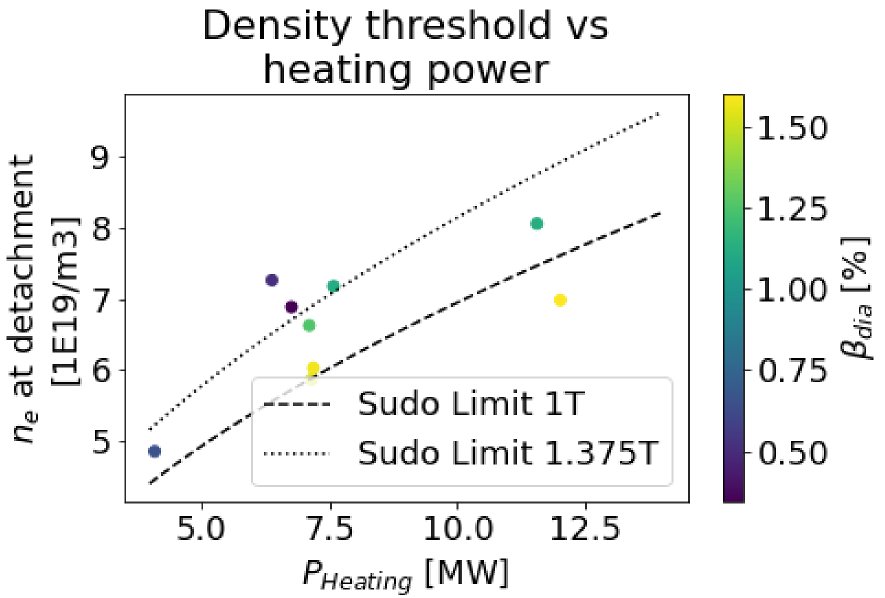
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) =

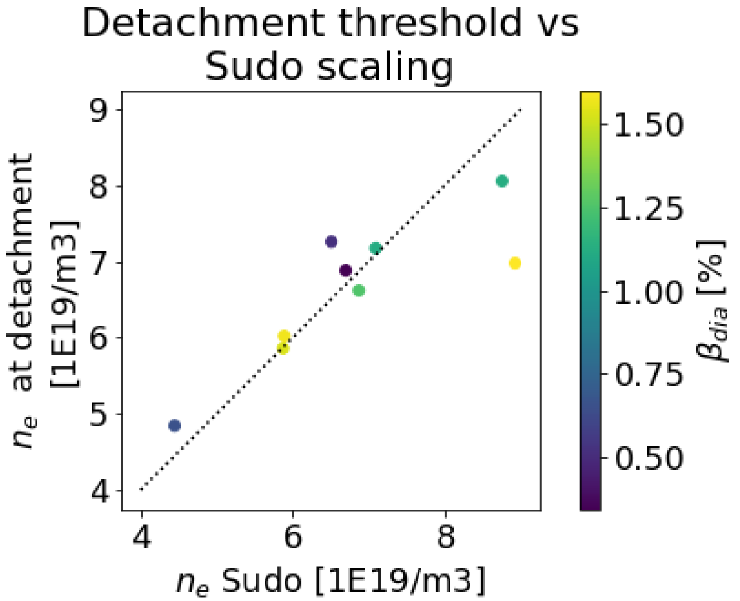
- (3.6m, CCW, 1.375T,1.2538, 100%)
- (3.6m, CCW, 1.0T, 1.2538, 100%)

Background and motivation: Study relationship of intrinsic detachment threshold and plasma beta by ramping density up until divertor LPs detect particle flux detachment. Vary both heating power and magnetic field to separate topology effect from Sudo scaling.

Results: 3 out of 4 corners of the power / field grid could be explored. At low field, operating NBI4 prevented reliable plasma startup (fuelling through gate valve?).







Pics of remote experiments from FZJ