(MAP) Session Report

Date: Apr. 26, 2024
Time: 10:22 – 16:44
Shot#: 190360 – #190475 (116 shots)
Prior wall conditioning: None
Divertor pump: ON
Gas puff: H_2, Ne

Apr. 26, 2024 (R.T. Ishikawa)

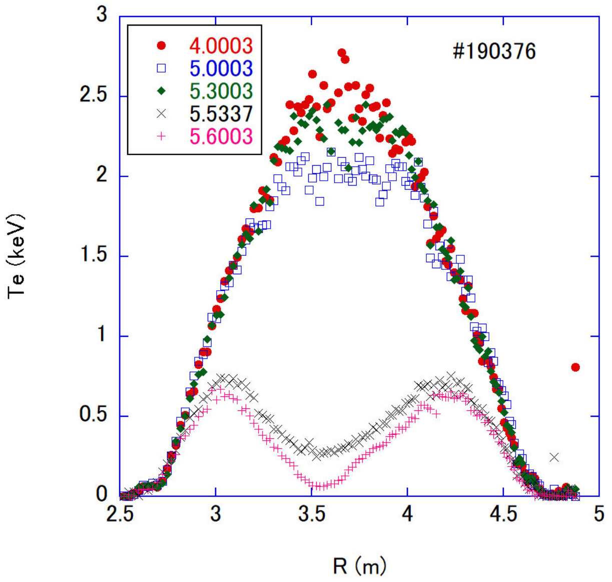
NBI#(1, 2, 3, 4, 5) = gas(H, H, H, H, H)=P(4.3, 4.0, 4.3, 3.9, 5.5) MW
ECH(77GHz) = ant(1.5-Uo, 5.5-U, 2-OUR)=P(-, 0.698, 0.380) MW
ECH(154GHz) = ant(2-OLL, 2-OUL, 2-OLR)=P(0.705, 0.889, 0.982) MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(-, -, -, -) MW

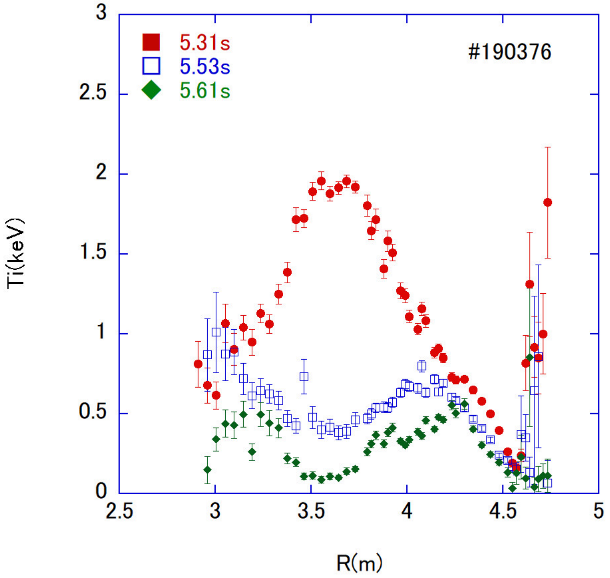
Topics
1. Simultaneous multi-wavelength spectroscopies for validation on atomic data and spectroscopic modelings for highly charged ions (I. Murakami)
2. Solid hydrogen pellet injection to plasmas in extended operational regime (H. Yamada)
3. Investigation of edge impurity transport in impurity-seeded detachment combined with high beta plasma (E. Wang)

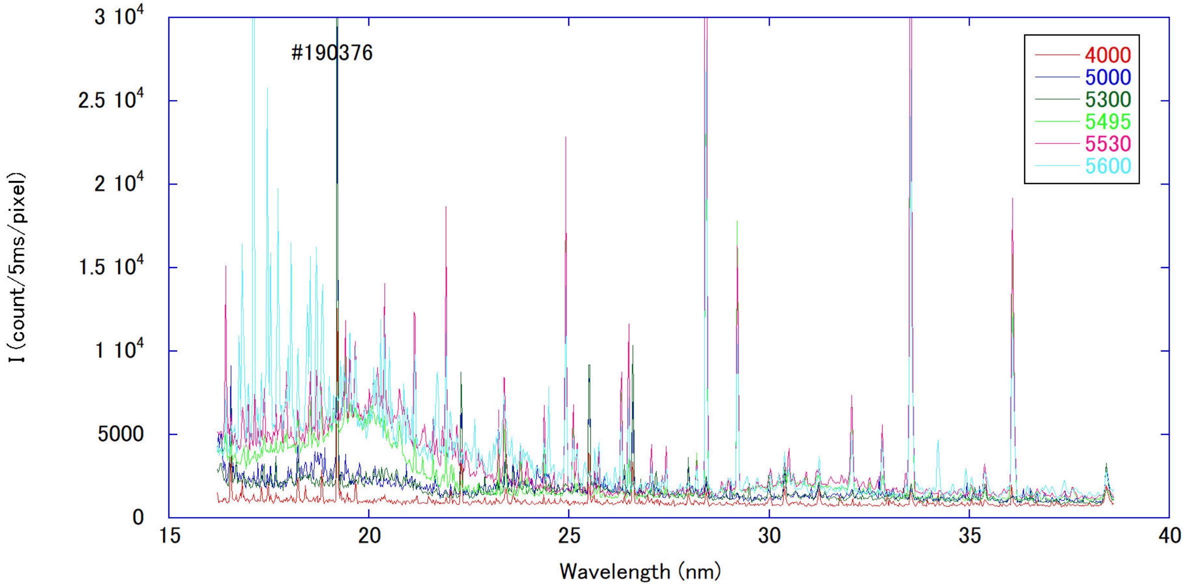
MAP: "Simultaneous multi-wavelength spectroscopies for validation on atomic data and spectroscopic modellings for highly-charged ions"

I. Murakami, D. Kato, H. A. Sakaue, T. Oishi, T. Kawate, Y. Kawamoto, M. Goto

- **Conditions:** #190360-#190380. NBI #1-#5. ECH. H2 gas. (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.2538, 100.0%)
- **Objectives:** Spectroscopic model (Collisional-radiative (CR) model) of tungsten ions is to be validated with the measured spectra using LHD, especially for low charged ions.
- **Experiments**: A tungsten impurity pellet was injected at 4.1s. NBI #1-3 were injected at 3.3-5.3s and NBI#4-5 were injected at 5.3-7.3s. EUV spectra at 3.0-10nm and 16-38nm were measured. Ion temperature was measured with modulating NBI #4.
- **Results:** Strong radiation power of accumulated tungsten at core causes temperature hole. Ion temperature distribution also shows hole structure. Quasi-continuum spectra produced by low charged tungsten ions were measured at 16-38 nm. Very weak profile was found at around 30nm, which is weaker than expected from the CR model.







Solid hydrogen pellet injection to plasmas in extended operational regime

X.Dai[1], H.Yamada[1], R.Sakamoto[2], N. Tamura[1,2]   [1]UTokyo, [2]NIFS

Background and objective

- This study aims at the comprehensive characterization of pellet penetration and deposited particles towards clarification of particle transport and optimization of a fueling scheme/scenario in a fusion reactor.
- While the Neutral Gas Shielding (NGS) model gives rough prediction of the penetration depth of a pellet, it misses important physical mechanisms such as shielding by plasmoid ablated from a pellet, drift motion, etc..
- Compilation of dataset of pellet injection/ablation with accumulation of missing data. Particularly, data on different NBI heating.

Experimental Condition   ■ R_{ax}=3.6m

- ■ NBI plasmas (#190384-190402) B=2.75T
- ■ NBI plasmas (#190403-190257) B=2T
- ■ Propellant gas: Ne, He

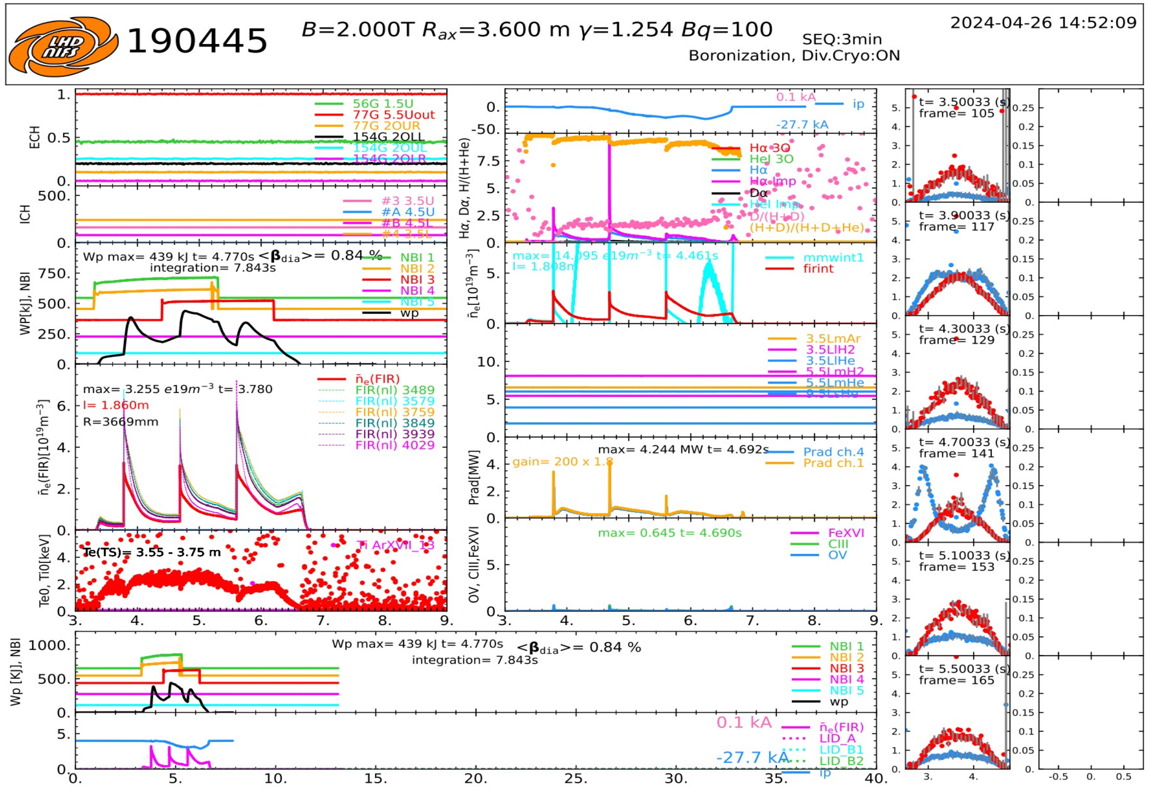
Results

- ■ Data on low-speed pellet of different radius with Ne gas as the propellant has been extended:

$$508\text{m/s} < V_p < 1339\text{m/s}$$

- ■ Missing regime of magnetic field in the dataset has been filled at 2T

Exp. 2024/4/26



Solid hydrogen pellet injection to plasmas in extended operational regime 2

Results 2

- Data on perpendicular NBIs only has been appended

Scope

- The existing dataset has provided the scaling expression of penetration depth λ in NBI heated plasms:

$$\lambda/a_{NBI}^{regression} \propto T_{e0}^{-0.30}\overline{n_e}^{-0.19}V_p^{0.24}B^{0.38}n_{f.ion}^{-0.25}$$

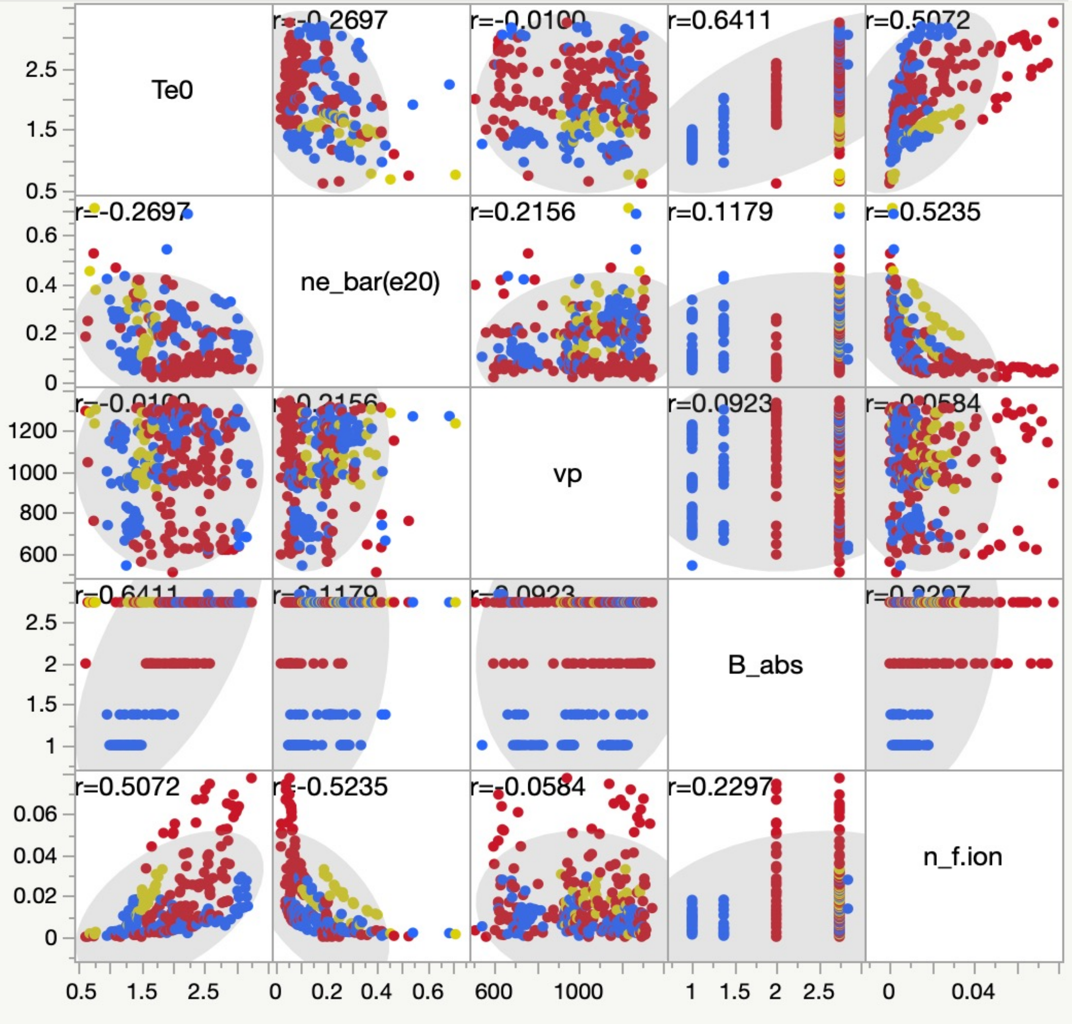
($n_{f.ion}$: fast ion density)

which suggests significant contribution of magnetic field and fast ion which are not included in NGS model.

- Extended dataset will improve the quality of the assessment of contributions from B and $n_{f.ion}$.
- Newly obtained data on perpendicular NBIs(40-60kev) only will be used for proceeding the comparison to data on tangential NBIs(180kev) to validate fast ion effects.
- Further study: calculate the velocity distribution function of fast ion using FIT3D code and aligning with HPI2 code.

Correlation between leading parameters

● existing dataset ● newly obtained data (tang. NBIs) ● newly obtained data (perp. NBIs)



Investigation of edge impurity transport in impurity seeded detachment combined with high beta plasma

(E. Wang)

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 1.375 T& 1 T, 1.2538, 100.0%)(# 190459 - #190474)

Objective:

To investigate edge impurity transport properties and its relation with edge magnetic topology in neon-seeded detachment scenarios with high beta.

Results:

- Neon-seeded detachment has been achieved in high beta plasma.
- Divertor Langmuir probe measurements shows more symmetry in deep detachment in some shots.
- The edge impurity distribution from VUV/EUV spectrometers will be analyzed with simulation EMC3-EIRENE.
- Edge magnetic topology will be calculated by HINT.