(SG1) Multi-phase and Atomic/Molecular physics group report

Mar. 29, 2024 (M. Kobayashi)

Date: Mar. 28, 2024
Time: 10:30 -16:45
Shot#: 188377 – 188499 (123 shots)

Prior wall conditioning: No
Divertor pump: Off
Gas puff: H2, Ne, Ar IPD: No
LID: No
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.8, 4.2, 4.1, 3.9, 2.7) MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(698, 380)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(705, 806, 982) kW
ECH(116GHz)=ant(2O-LR)=P(-)kW
ECH(56GHz)=ant(1.5-U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(-, -, -, -) MW

Topics

1. Study of edge impurity transport by utilizing multiple spectroscopy diagnostics (T. Nishizawa)
2. Impurity behaviour study in LHD plasmas using VUV spectroscopy in experiment with W TESPEL injections (T. Fornal)

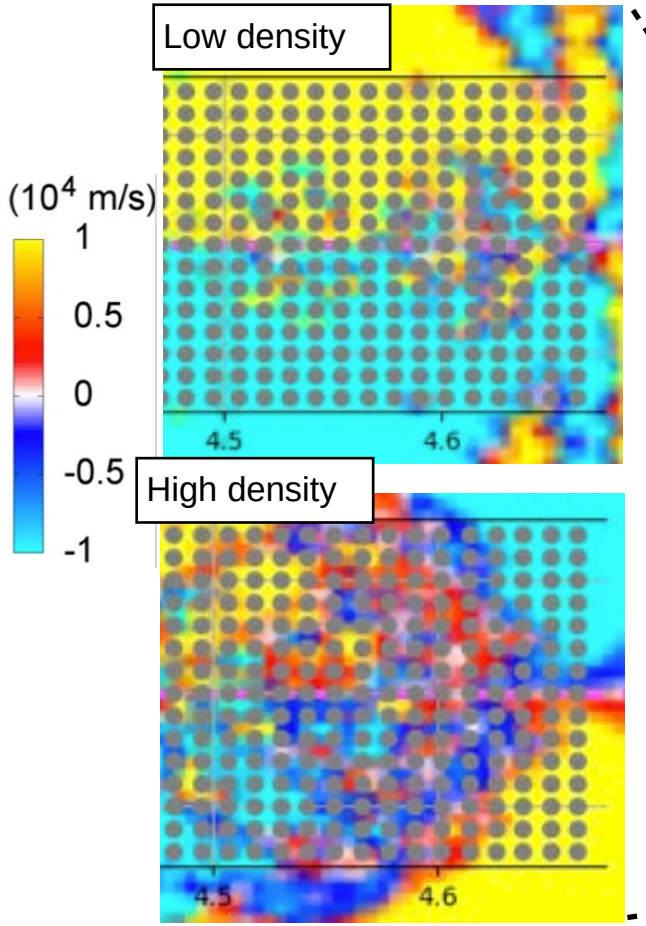
Impurity flow reveal in open field lines

(T. Nishizawa, T. Kobayashi, M. Kobayashi, Y. Yoshinura, T. Oishi, and K. Ida)

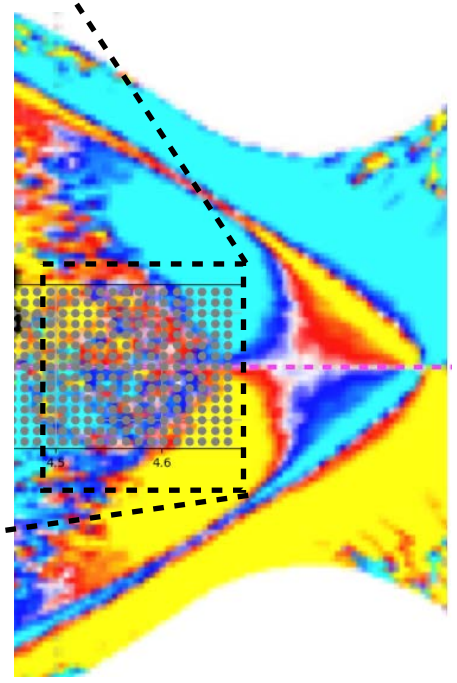
Shot #: 188379 – 188451 **Mar 28, 2024**

objective: To measure the upstream flow of impurities driven by thermal force

C^3+ toroidal velocity (EMC3-eirene)



S. Dai et.al. Nucl. Fusion (2018)

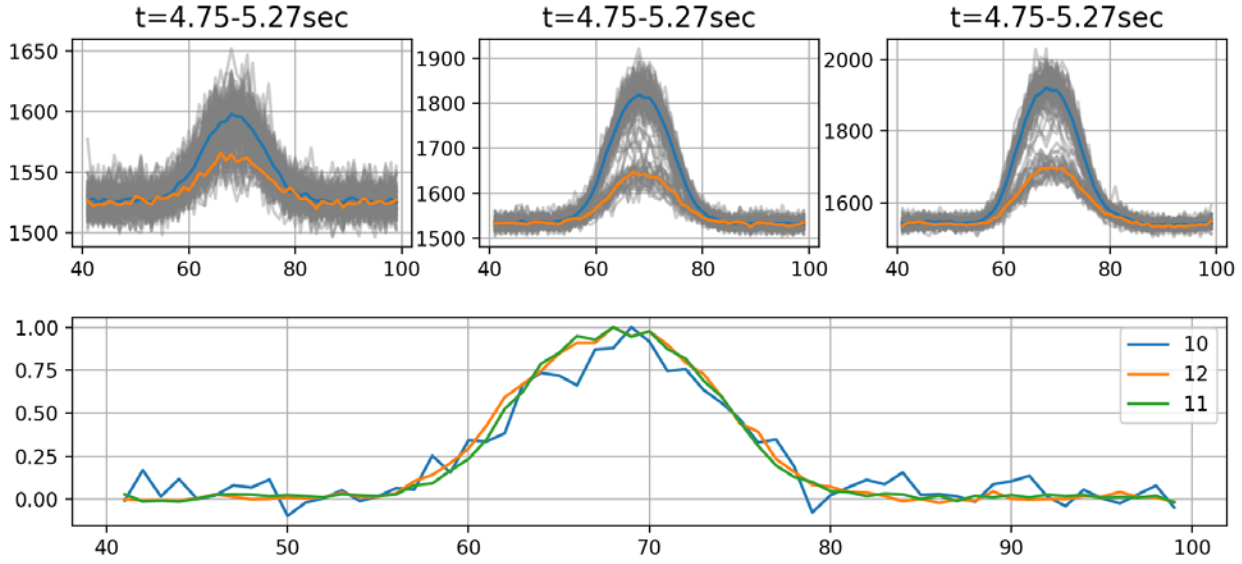


method: The toroidal velocity of C^6+ and bulk ions near the LCFS are measured by using CXS.

Done: Density has been scanned at Rax=3.6 m for three different condition.

1. Full power of parallel NBIs
2. Half power of parallel NBIs
3. With Neon puff

#188402 ne~1e+19 m^-3 low



CXS 529nm spectra, flow seems to be similar in the vertical direction

Not consistent with EMC3-eirene.

Impurity behaviour study in LHD plasmas using VUV spectroscopy in the W TESPEL injection experiment

(T. Fornal, N. Tamura, M. Gruca, M. Kubkowska, C. Suzuki et al.)

Magnetic configuration: (R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CCW, 2.75 T, 1.2538, 100.0%)
Shots: #188455 - #188489

Background

- In the recent LHD experiment, some successful TESPEL injections containing W were performed for an electron density of $1 – 5 \times 10^{19}$ m^{-3}. Some experimental discharges suffered from fragmented TESPEL capsules. The main goal of this experiment was to check if the accumulation of W is observed, as in the previous experiments in D, and to study the impurity transport time of W in LHD plasmas. The obtained results, which we eagerly anticipate, will be compared with future results in W7-X. The injection of W allowed us to study impurity behaviour in various plasma conditions. The next step will be to analyze the collected data and perform numerical simulations using Flexible Atomic Code.

Objectives

- Estimate the impurity decay time of W based on the corresponding line intensity evolution.
- Estimate the impurity decay time based on the line intensity evolution for various electron densities of plasma (1-5E19 m^{-3}).
- Estimate the impurity decay time based on the line intensity evolution for various W tracer amounts (0.5-3E17).
- The identification of the spectra will be supported by the simulations using Flexible Atomic Code (using the Collisional-Radiative CR model).

Impurity behaviour study in LHD plasmas using VUV spectroscopy in the W TESPEL injection experiment
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Results

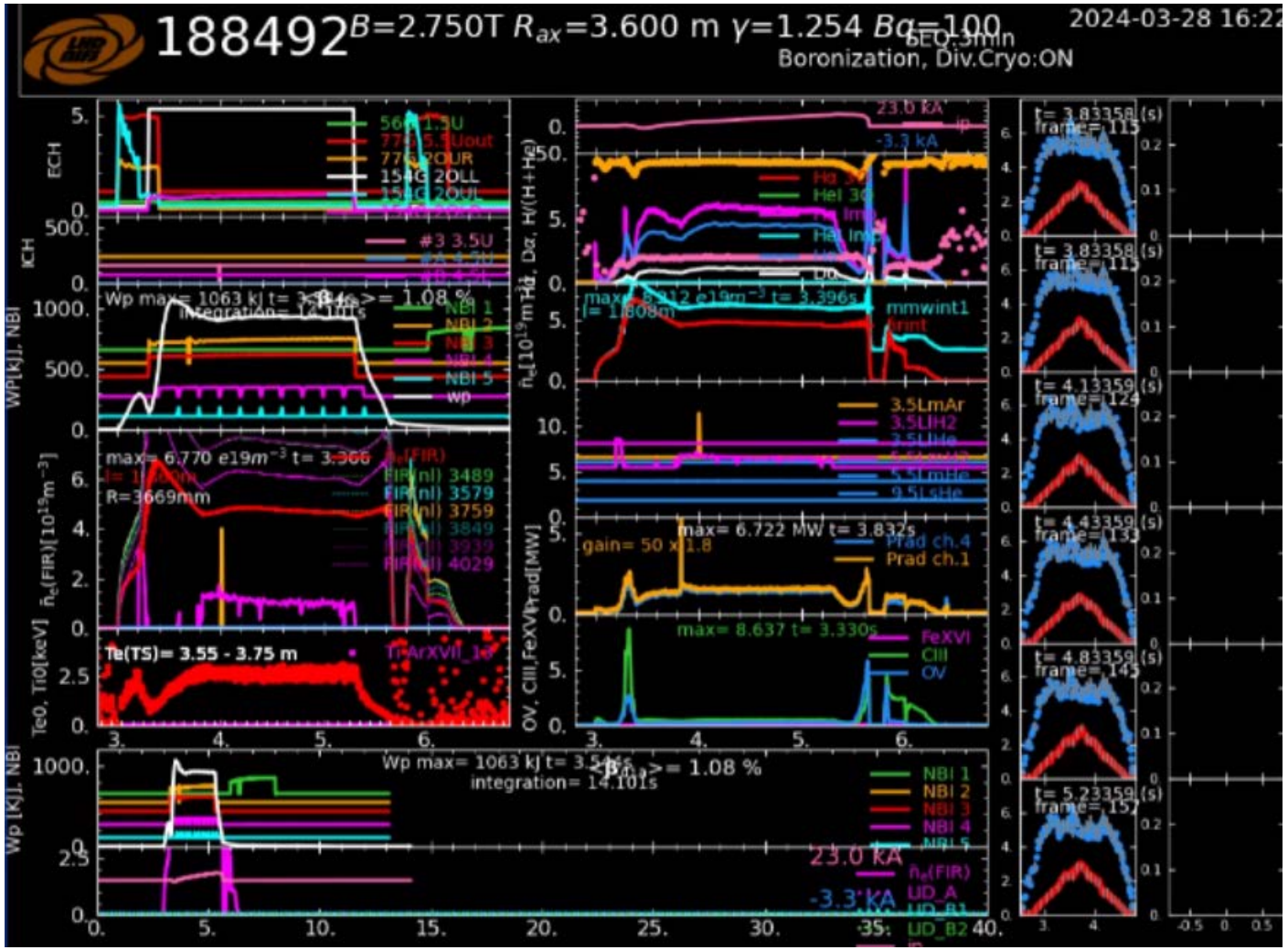
- **TESPELs are successfully injected** into the EC+NBI-heated LHD H plasmas with n_e in the range of 1.5 - 4.5E19 m^{-3}
- Apart from density scan – also scan over tracer amount was performed
- (in the range of 0.5 - 3.0E17 particles)
- Density scan over various tracer amounts was possible to achived.

n_W ¥ n_e	1.5E19	2.5E19	4.5E19
0,5	×	✓	✓
1,0	✓	✓	×
2,0	×	✓	✓
3,0	✓	✓	✓

- Some discharges were not performed successfully; however, the collected data should contain useful information to be analyzed in the next step.
  SOXMOS spectra analysis and their simulation with FAC → to be performed.

Impurity behaviour study in LHD plasmas using VUV spectroscopy in the W TESPEL injection experiment

(T. Fornal, N. Tamura, M. Gruca, M. Kubkowska, C. Suzuki et al.)



In the experiment **with W injections**, W was successfully injected into the plasma. The quality of the SOXMOS data are to be investigated in the next step.

On the left – one of the successfully performed TESPEL injections with the W tracer amount of 0.5E17 particles