

# Daily Report for 2025-12-25

H. Nakano, R. Yanai

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**Date:** December 25, 2025

**Time:** 9:58 – 17:15

**Shot:** 200222 – 200252 (31 shots)

**Prior wall conditioning:** He

**Divertor cryopump:** On

**Gas puff:** H<sub>2</sub>, He, Ne

**Pellet:** No

**IPD:** B, Li

**NBI:** #1, #2, #3, #4

**ECH:** 2-OUR (77GHz), 2-OLL (154GHz), 2-OUL (154GHz)

**ICH:** 3.5U, 4.5U/L

## Topics

1. Demonstration of p-<sup>6</sup>Li fusion reaction using Impurity Powder Dropper(IPD) on LHD (M. Zarnstorff, M. Osakabe)
2. Super-long pulse discharge with integrated operation – IPD and impurity seeding – (S. Masuzaki)

# Demonstration of p-<sup>6</sup>Li fusion reaction using Impurity Powder Dropper(IPD) on LHD

M. Zarnstorff (PPPL), M. Osakabe, K. Ogawa, M. Motojima, S. Masuzaki, M. Shoji, M. Yoshinuma and T. Qian (U. of W)

## Experimental conditions:

( $R_{ax}$ , Polarity,  $B_t$ ,  $\gamma$ ,  $B_q$ ) = (3.6 m, CCW, 2.75 T, 1.2538, 100.0%)

#200222 - #200237 :

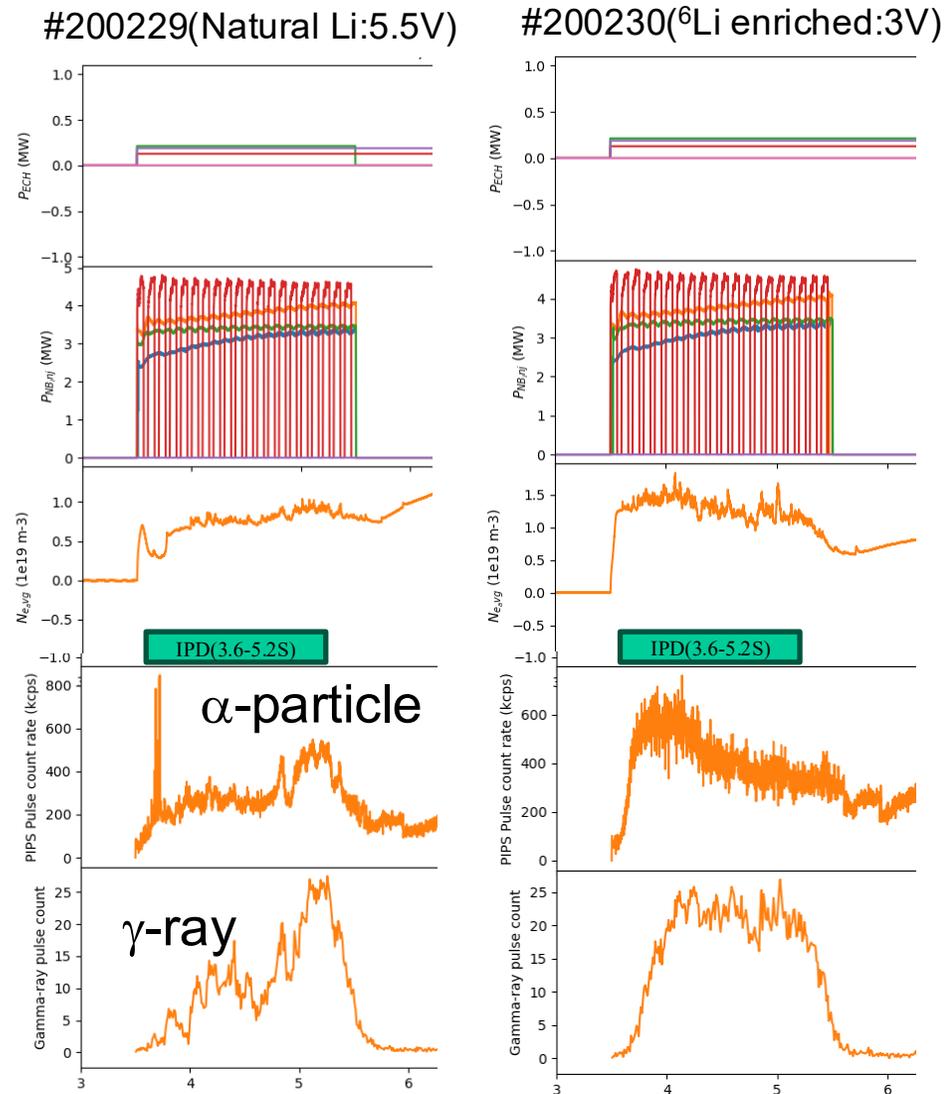
- #200222-6: Clean up discharges of wall to reduce the electron density
- #200227-237
- NBI#1-#4, ECH(77GHz, 154GHzx2), ICH (3.5U, 4.5U/L applied after t=5.5s)

## Motivation and method:

- Document p-<sup>6</sup>Li and p-<sup>7</sup>Li reactions through fusion products. Changing the amount of metal <sup>6</sup>Li enriched and natural Li(<sup>6</sup>Li:<sup>7</sup>Li=7.5:92.5) granule through the flow rate setting (Voltage setting of Piezo vibrator) of IPD.
- Trying to evaluate the effect of the p-<sup>6</sup>Li reaction not only by  $\gamma$ -ray and Lost  $\alpha$ -particle detector but also by the high-resolution mass analyzer of residual gas.
- Long pulse NB-discharges of 6s are also tried to maximize the production of fusion products of p-<sup>6</sup>Li reaction, i.e., <sup>3</sup>He during a single discharge.

## Results:

- The difference between <sup>6</sup>Li and natural Li observed (<sup>6</sup>Li larger) in  $\alpha$ -particle and  $\gamma$ -ray signals. Normalization of these signals by Li line intensities (Charge Exchange Spectroscopy) are necessary for fair evaluation.
- Detailed analysis on spectra of  $\alpha$  and  $\gamma$  are necessary to clarify the effect of fusion reactions.



# Super long pulse discharge with integrated operation

## -IPD and Impurity seeding-

S. Masuzaki

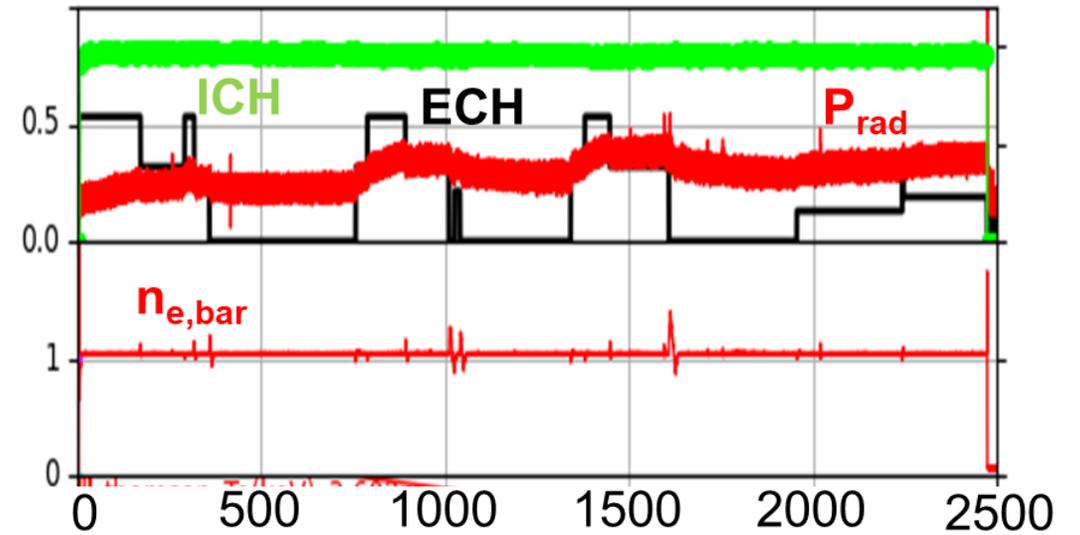
Shot #: 200238-200252

$(R_{ax}, B_t, \gamma, B_q) = (3.6 \text{ m}, -2.75 \text{ T}, 1.2538, 100.0\%)$

Working gas: He, Impurity gas: N2, IPD: B

$P_{ECH} \sim 0.5 \text{ MW}$ ,  $P_{ICH} \sim 0.8 \text{ MW}$

#200238



Time evolutions of heating power and line averaged density during #200238

## Background and Purpose

- By employing boron and/or other powder dropping together with impurity seeding, it is expected to achieve significantly longer discharges, potentially exceeding one hour, while maintaining effective control of fueling, impurities, and divertor heat load.
- The international long pulse discharge database will also be enriched with new data.

## Result

- The longest discharge duration on this day was  $\sim 2476$  s, in which impurity seeding and impurity powder dropping were not conducted.
- B powder dropping, and N2 seeding from 3.5L, 5.5L, and 9.5L ports were conducted during discharges. The effects of them will be analyzed.



LHD experiment completed!!!