(TG1) Multi-ion Plasma group report

Dec. 1, 2022 (H. Kasahara)

Date: Nov. 30, 2022, Time: 9:45~18:45
Shot# 184709~184864
Prior wall conditioning: GD-H2, Div cryo: No, Gas puff: H_2, D_2, He, Ar, Pellet: H, D, C

NBI(1, 2, 3, 4, 5) = gas(H, H, H, D, D) = P(3.46, 4.07, 3.88, 8.36, 8.40) MW
ECH(56GHz,15U) = P(-) MW
ECH(77GHz, 55Uo, 2Our) = P(0.70,-) MW
EH(154GHz, 2Oll, 2Oul, 2Olr) = P(0.72,0.80,0.99) MW
ICH(38.47MHz, 3.5U, 3.5L, 4.5U, 4.5L) = P(0.82, 0.68 ,0.80, 0.74) MW
Neutron yield integrated over the experiment = 2.8×10^{16}

With the miss operation of the feedback gas-puff system, Vacuum deterioration occurred, but since the gate of the cryo-pump was closed, there was no effect on the cryo-pump. (17:11)

Topic

1. Wall D/H recycling process after pellet fueling (G. Motojima)
2. Isotope mass effects on sustainment of e-ITB plasma (N. Kenmochi)
3. Transport study in ECRH superposed ion ITB plasma (H. Nakano)
4. Plasma ICRH production in low magnetic fields for ICRH wall conditioning in hydrogen(Y. Kovtun, V. Moiseyenko, H. Kasahara)

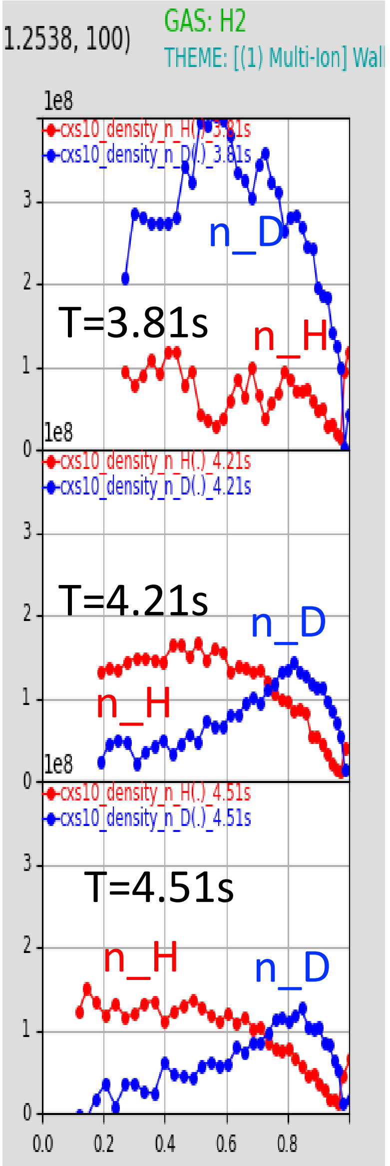
Wall D/H recycling process 2 (G. Motojima)

- ✓ #184711-184736
- ✓ R_{ax}=3.6m, B=2.75T, γ=1.254, Bq=100%
- ✓ Working gas: D_2, SSGP(H_2), H/D pellet
- ✓ Motivation
  - ❖ It was curious that despite the D beam of all NBIs and D-rich wall conditions, core-flat n_H and hollow n_D profiles (non-mixing state) were obtained on Nov/25.
    → **What is the source of H?**
  - ❖ We investigated n_D and n_H profiles in the mixture case where t-NBI is H beam and p-NBI is a D beam.

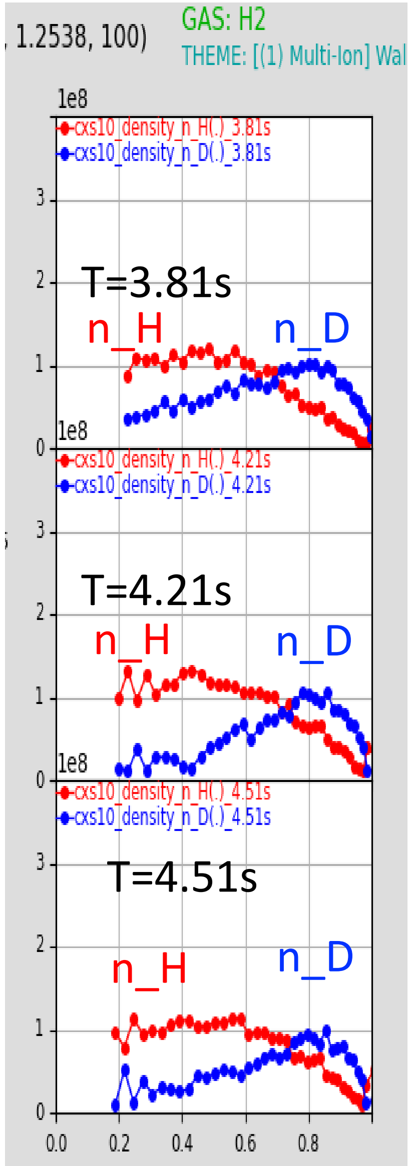
✓ Results

- ❖ For the mixture case, n_H is core-flat and n_D is hollow profiles, which is reasonable given the NBI beam source (H) and D-rich wall recycling. However, it is still in a non-mixing state (always hollow n_D profile).
- ❖ To change the n_D profile, D-pellet was injected. 5ms after pellet injection, the profile is a hollow profile, but 35 msec after injection, the profiles of n_H and n_D are similar and in a mixing state.
  → **Hard to establish mixing state in these experiments**

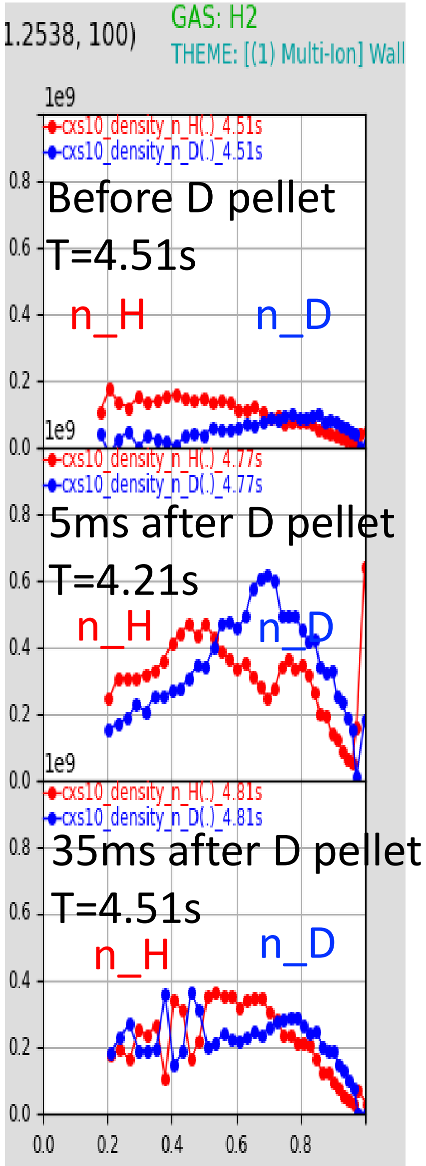
#184392
t-NBI(D), p-NBI(D), D-rich wall
@2022/11/25



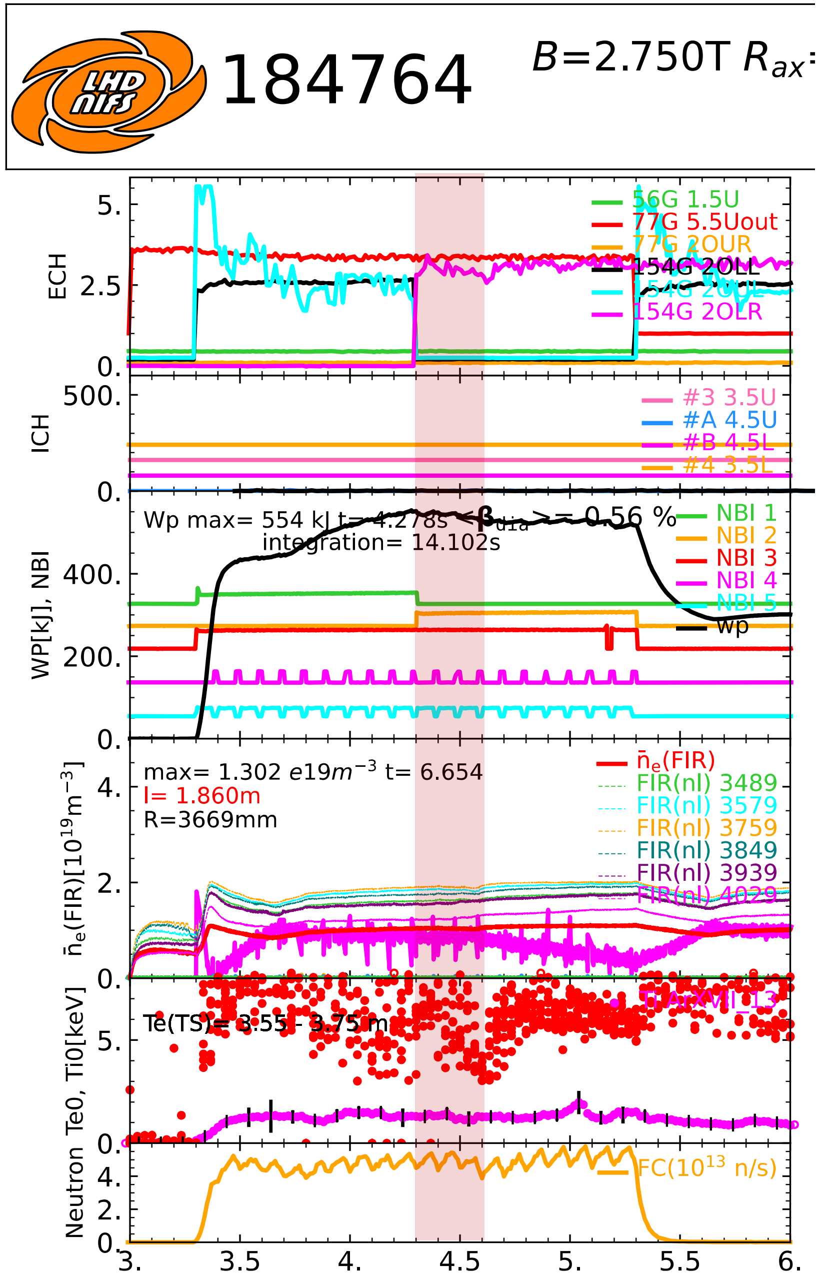
#184718
t-NBI(H), p-NBI(D), D-rich wall
@2022/11/30



#184728 D pellet
t-NBI(H), p-NBI(D), D-rich wall
@2022/11/30



Isotope mass effects on sustainment of e-ITB plasma



(N. Kenmochi)

Experimental conditions:

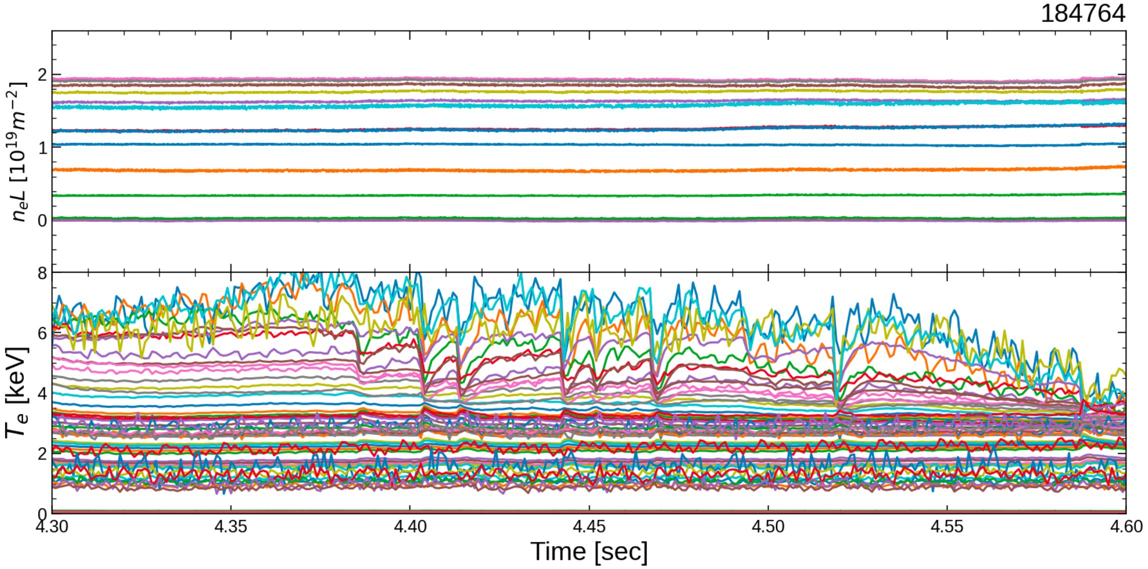
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.2538, 100.0%)

Co. to Ctr. current drive at center region (# 184746 - #184781), H/(H+D)=0.8

Objective: To clarify the isotope mass effect of the e-ITB sustainment and turbulence pulse propagation.

Results:

- ✓ Minor collapses of e-ITB was repeatedly observed around m/n=1/2 magnetic island.
- ✓ The measurement positions of both BS and HIBP were scanned in a shot-to-shot basis.
- ✓ Non-thermal component of electron temperature was measured with high temporal resolution by combining fast Thomson scattering measurement and 9-CH polychromator.
- ✓ The isotope mass effects for minor collapse and turbulence spreading will be investigated.



Transport study in ECRH superposed ion ITB plasma (H. Nakano)

Background and Objective

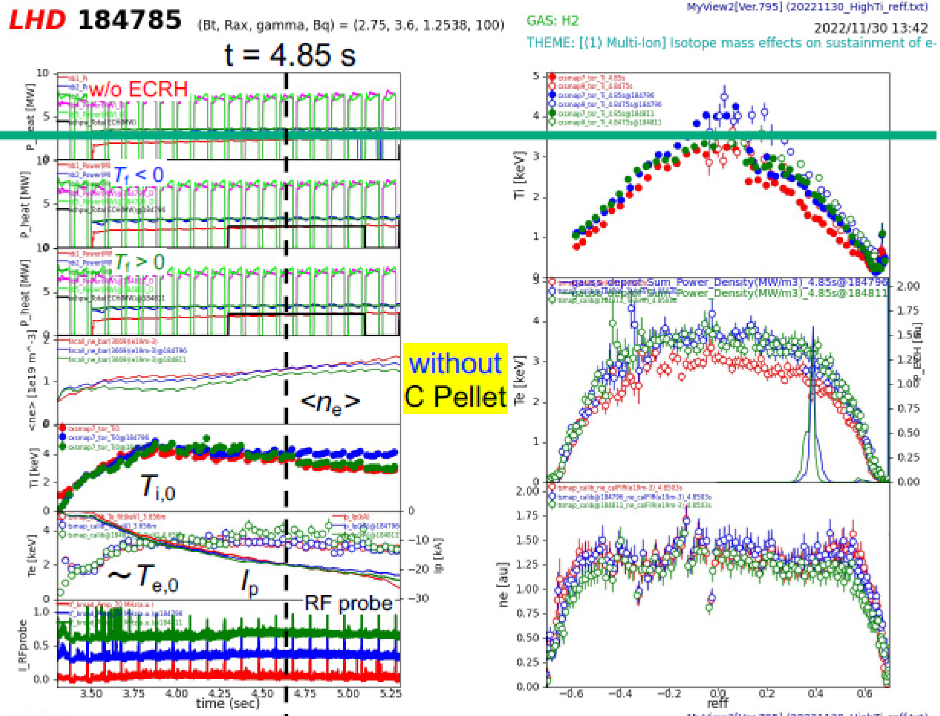
- The ECRH superposition in the peripheral region to the high *T*i discharge improved *T*i as well as the thermal confinement.
- Influence of the Electric field and ECCD direction on the high *T*i discharge with the off-axis ECRH is studied.

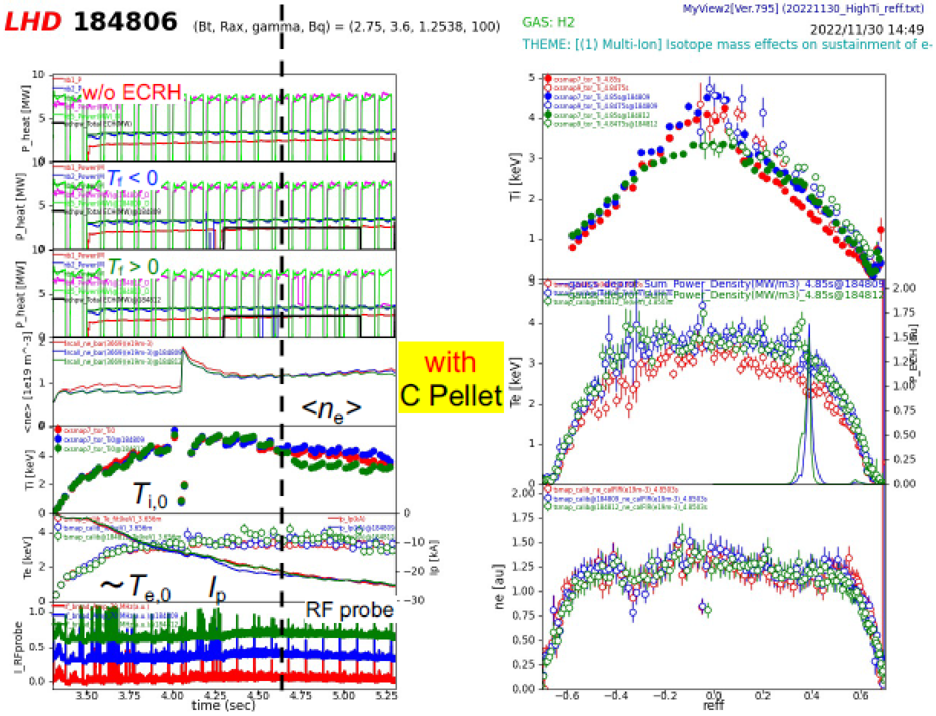
Experimental Condition (Third day for H/D ratio scan exp.)

- Shot: 184782 - 184818
- (Rax, Polarity, Bt, γ, Bq) = (3.60 m, CW, 2.75 T, 1.2538, 100 %)
- NB1-3: H beam, NB4-5: D beam, ECH: on/off axis, ICRH: RFDC, C pellet, HIBP, BS (Back Scattering)

Results

- Higher central T_i was observed by off-axis ECRH in CW magnetic field polarity, where counter-direction current drive (ctr-CD) was dominant by tangential NBs.
- Peripheral T_i increased by the ECRH with both co- ($T_f > 0$) and ctr- ($T_f < 0$) CD, the ECRH with co-CD increased the central T_i ($T_{i,0}$). However, the ECRH with ctr-CD did not significantly influence $T_{i,0}$ in high T_i discharge without carbon pellet, and decreased $T_{i,0}$ in high Ti discharge with carbon pellet. The $T_{i,0}$ decrease started from approx. 0.3 sec after ECRH start.
- Transport and fluctuation analyses including the electric field will be done.





Red: w/o ECRH
Blue: w/ ECRH at $\rho = 0.6$ ($T_f > 0$, co-CD)
Green: w/ ECRH at $\rho = 0.6$ ($T_f < 0$, ctr-CD)

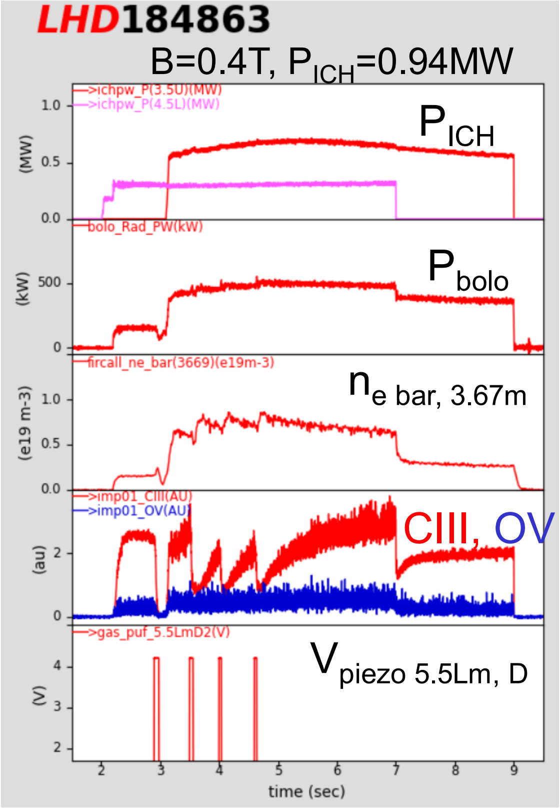
Plasma ICRH production in low magnetic fields for ICRH wall conditioning in hydrogen (Y. Kovtun, V. Moiseyenko, H. Kasahara)

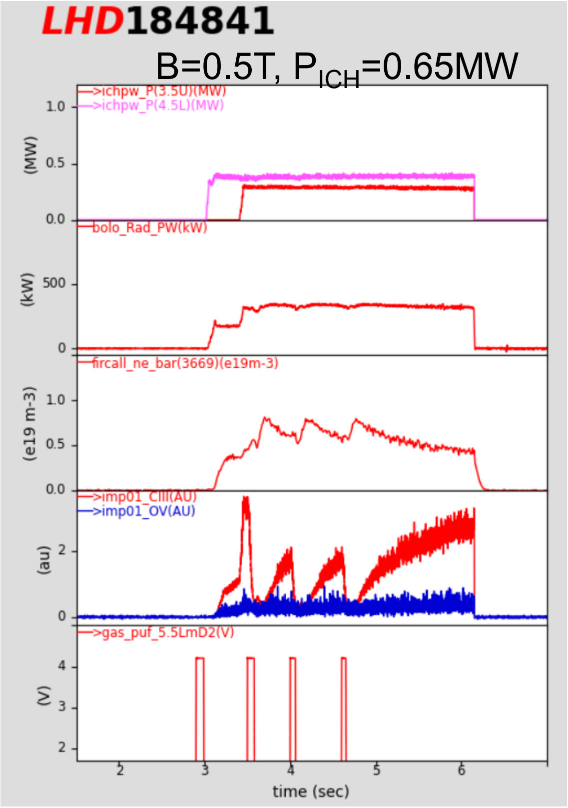
Magnetic Configuration, Shots

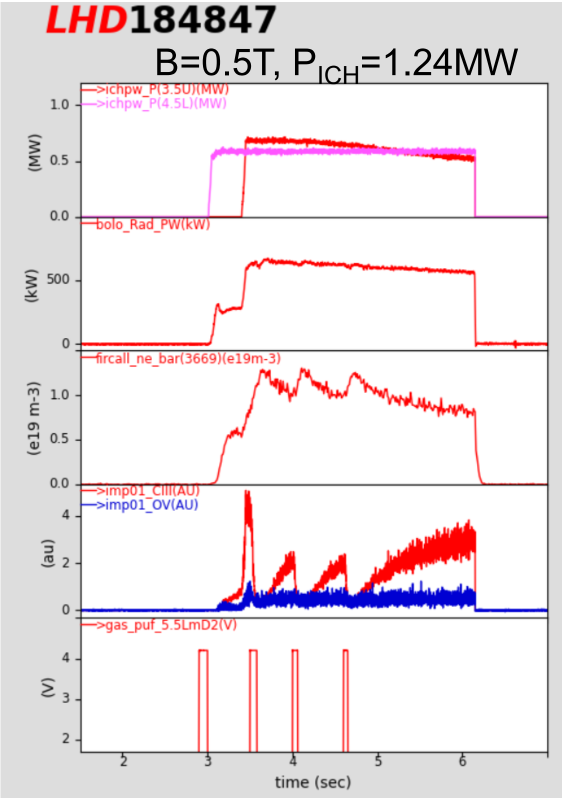
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 0.5 T, 1.2538, 100.0%), #184819 – #184853

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 0.4 T, 1.2538, 100.0%), #184854 – #184864

The goal of this experiment: To study the plasma production with only ICRF heating (higher harmonic cyclotron resonance conditions) on the low magnetic field configuration in D plasmas.







Results:

- The n_{e_bar} of 1.2e19 m^{-3} was achieved with P_{ICH} of 1.2MW and four series gas puffing (100ms, 80ms, 60ms, 50ms).
- The achieved densities were proportional to the injection power of ICH, and electron densities were dropped with large-amount gas puffing and the low-level P_{ICH} cases.

Checking the neutral pressure and these contents using QMS