(TG1) Multi-ion group report

Date: Feb. 15, 2022
Time: 13:46-15:43
Shot#: 178970-179009 (40 shots)
Prior wall conditioning: No
Divertor pump: YES
Gas puff: H₂, Ar
H pellet: YES
NBI#(1, 2, 3, 4, 5) = gas(H, H, H, H, H) = P(4.4, 2.0, 4.0, 3.9, -) MW
ECH(77 GHz) = ant(5.5-Uout, 2-OUR) = P(703, 792) kW
ECH(154 GHz) = ant(2-OLL, 2-OUL , 2-OLR) = P(979, 930, 986) kW
ECH(56 GHz) = ant(1.5U) = P(-) kW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(-) MW
Neutron yield integrated over the experiment = 1.8×10¹¹ (TG1)

Topics
1. Isotope effect in high-density ECH plasma after hydrogen pellet injection (T. Tsujimura)
Isotope effects in high-$n_e$ ECH plasma after hydrogen isotope ice pellet injections

T. Tsujimura

Experimental conditions:

$$(R_{ax}, B, \gamma, B_q) = (3.60 \text{ m}, \text{CCW 2.85 T, 1.2538, 100.0\%})$$

Results:

• Typical discharge is shown in the figure at the right (#178995).
• High-$n_e$ ECH plasma was sustained after injection of three H pellets together with H gas puff.
• H rich condition was obtained: $D/(D+H) \sim 0.1$ in comparison to $\sim 0.8$ on Jan. 12.
• Max. $n_e0 \sim 10 \times 10^{19} \text{ m}^{-3}$, $T_{e0} \sim T_{i0} \sim 1 \text{ keV}$.
• Thermal relaxation from electrons to ions increased $T_{i0}$ up to $\sim 1.5 \text{ keV}$ at $T_{e0} \sim 2.5 \text{ keV}$, $n_e0 \sim 3 \times 10^{19} \text{ m}^{-3}$.
• peaked $n_e$, $T_e$, and $T_i$

Motivation:

• In this campaign, the third 154-GHz gyrotron is functional in full power.
• In contrast to 21st campaign, experimental data in wide ranges of ECH power and $n_e$ were accumulated to discuss isotope effects in high-$n_e$ ECH plasma.
• D phase on Jan. 12

#178995
Isotope effects in high-$n_e$ ECH plasma after hydrogen isotope ice pellet injections

T. Tsujimura

Results (cont.):

- Injection power $P_{ECH}$ was scanned from 0.9 MW to 3.7 MW with one 77 GHz perpendicular injection and three 154 GHz oblique injection.
- $n_{e,\text{bar}}$ was scanned from $1 \times 7 \times 10^{19}$ m$^{-3}$ by changing the number of pellets: 1-3.
- $W_p$ was beneath ISS04 in H plasma, but almost along ISS04 in D plasma.
- $T_{e0}$ was similar or relatively smaller in H plasma than D plasma.
- $T_{i0}$ was almost 1-1.5 keV in the scanned $n_e$ range as $T_{e0}$ decreased.

- $n_e$ fluctuations were measured with PCI and DBS to discuss ion scale turbulence.
- Power balance analysis will be performed in comparison with neoclassical and turbulent transport.
- Comparison with W7-X pellet discharges is desirable.

\[ P_{ei} \propto \frac{Z_i^2 n_e^2}{m_i T_e^{3/2}} (T_e - T_i) \]