(TG1) Multi-ion group report

Oct. 14, 2022 (M. Kobayashi)

Date: Oct. 13, 2022
Time: 9:34 -10:53, 15:35 – 18:45
Shot#: 180308 – 180333, 180406 - 180466 (87 shots)

Prior wall conditioning: No
Divertor pump: On
Gas puff: H2 IPD: No
LID: Off
NBI#(1, 2, 3, 4, 5)=gas(H, H, -, H, H)=P(3.7, 3.4, 2.1, 3.5, 3.6) MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(333, 365)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(398, 364, 343) kW
ECH(116GHz)=ant(2O-LR)=P(-)kW
ECH(56GHz)=ant(1.5-U)=P(288)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.28, 0.33, 0.13, 0.15) MW
Neutron yield integrated over the experiment = 5.1×10^{12}

Topics

1. Research of ICRF antenna property by the power modulation in LHD (D. Du, K. Saito et al.)
2. Experimental tests of lithium powder injection for plasma modification in stellarator geometries (R. Lunsford)

Research of ICRF antenna property by the power modulation in LHI

D. Du, K. Saito, J. Kwak, T. Seki, H. Kasahara, R. Seki

- **Shot No:180308-180333, 180406-180429**
- **Experiment conditions:**

(Rax, B_t, γ, B_q, Polarity)=(3.6m, 1T and 2.75T, 1.2538, 100%, **CW**) , Working gas: H_2, n_e=0~5×10^{19} m^{-3}, Heating system:ICRF(3.5U, 3.5L, 4.5U, 4.5L), ECH (0.3s for start-up), NBI(#1, #2)

- **Experiment purpose:**

1) Comparing the S matrix of U and L antennas (ICRF antenna property with COMSOL simulation

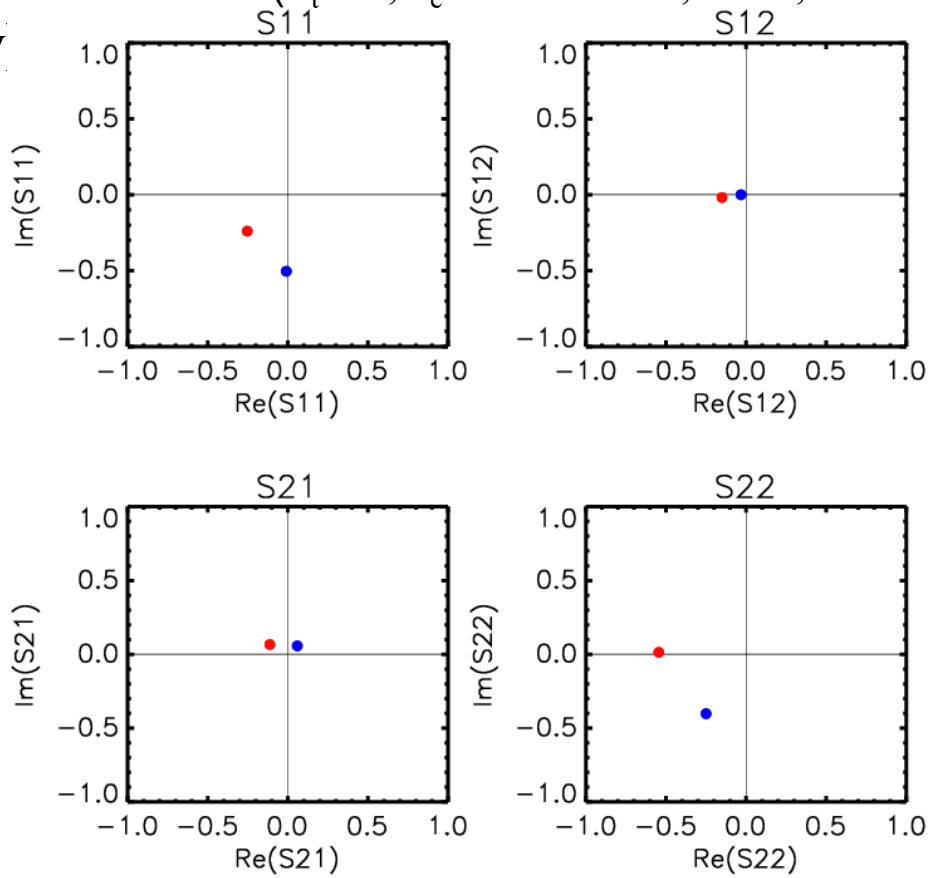
2) Designing load resilient system for generalized conjugate-T by S matrix

we measure the S matrix with real plasma.

- **Experiment results:**

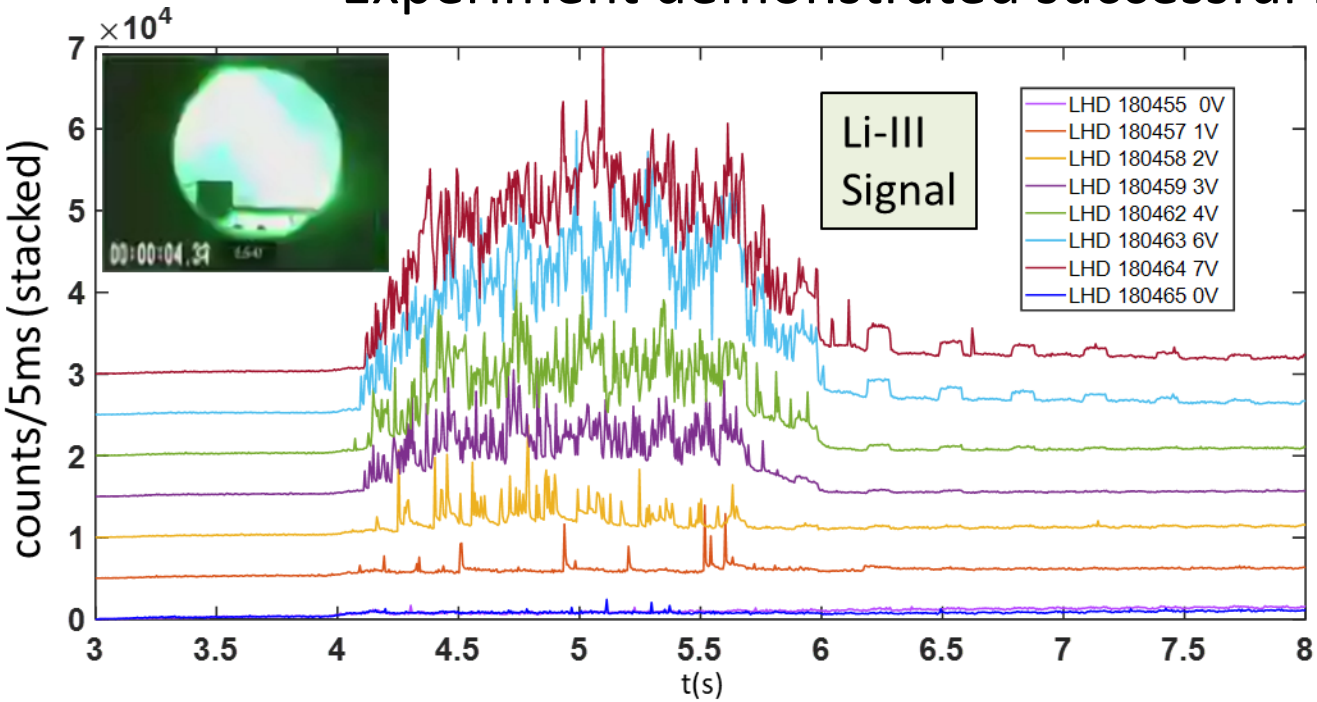
On Oct. 12, we meaured the S matrix with the polarity of CCW . When other conditions are the same, the S matrix has a different magnitude and phase with the magnetic field changing from CCW to CW. Detailed analysis will be done in the future.

#180312(B_t=1T, n_e=5×10^{19} m^{-3} , CW, red color)
#180297(B_t=1T, n_e=5×10^{19} m^{-3} , CCW, blue color)



Lithium granule injection into LHD plasmas

Experiment demonstrated successful injections of 850 micron Li granules.



37 Discharges executed first with NBI train for extended injections and then NBI stack for high Li fluence

IPD demonstrated ability to : 1) Inject granules one at a time (low excitation)

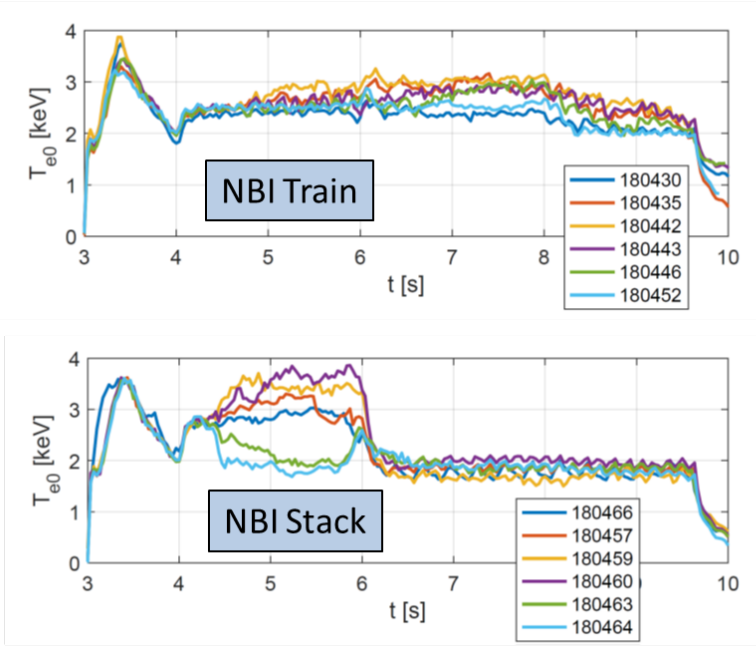
2) Inject in continuous stream (high excitation).

Injection level was increased until density rise was observed, but stopped before causing discharge collapse.

Preprogrammed gas puff series employed to observe real time changes in recycling

Reference discharges at the beginning and end of the series show minimal Li buildup over the shot series.

37 Discharges (24 w/Li) both with NBI train and NBI stack



180430 – Reference
180452 – 1V
180435 – 2V
180442 – 2.5V
180443 – 3V
180446 – 3.5V

180466– Reference
180457 – 1V
180459 – 3V
180460 – 3.5V
180463 – 6V
180464 – 7V

Electron temperature increase demonstrated during moderate injections

Past a critical level density control is compromised and temperature is observed to decrease

Variations in NBI power levels will require care during shot analysis