

# (TG4) Plasma instability group report



Oct. 20, 2022 (Y. Takemura)

Date: Oct. 19, 2022

Time: 9:50 - 13:12, 16:57 - 18:45

Shot#: 180791-180855, 180914-180945 (97 shots)

Prior wall conditioning: Off, Divertor pump: On

Gas puff: H<sub>2</sub>, D<sub>2</sub>, Pellet: <sup>6</sup>LiF

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(2.2, 3.8, 3.2, 4.2, 3.6)MW

ECH(56GHz)=ant(1.5-U)=P(0.29)MW

ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, 0.79)MW

ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.72, 0.80, 0.83)MW

ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.96, 0.86, 0.96, 0)MW

Neutron yield integrated over experiment = (1.5E+13)

## Topics

1. Observation of knock-on tail (KT) formation using DD neutrons and <sup>6</sup>LiD γ-rays  
(H. Matsuura, K. Ogawa)
2. Study of Fast-Ion Stiffness in Alfvén-Eigenmode at Helical Device (S. Kamio, K. Nagaoka)  
(Piggyback) Validation of high-energy NB shine-through model (S. Sumida, M. Osakabe)

# Observation of knock-on tail (KT) formation

H. Matsuura, K. Ogawa et al.

Experimental conditions: :  $(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100)$

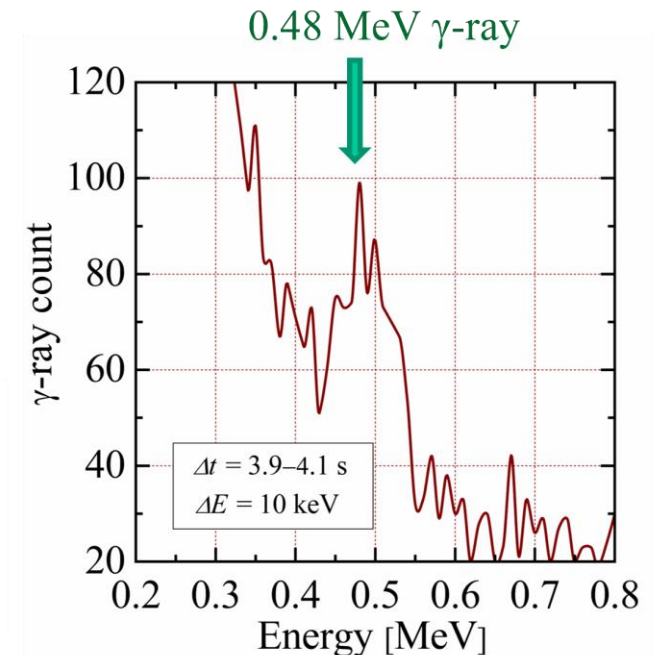
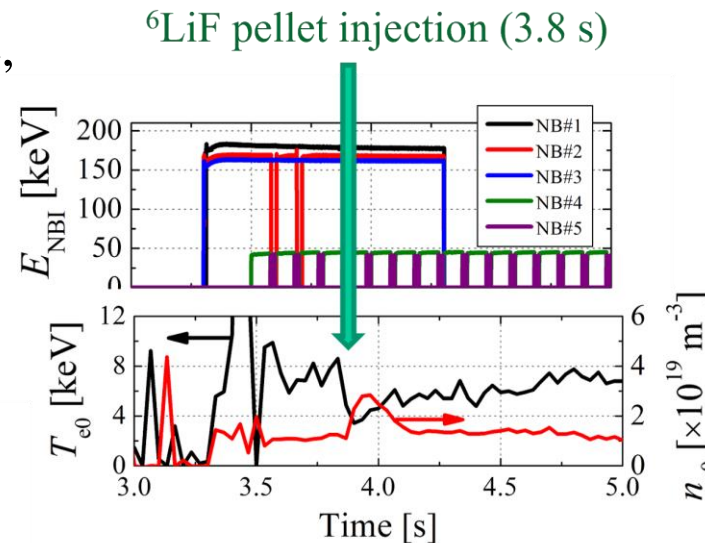
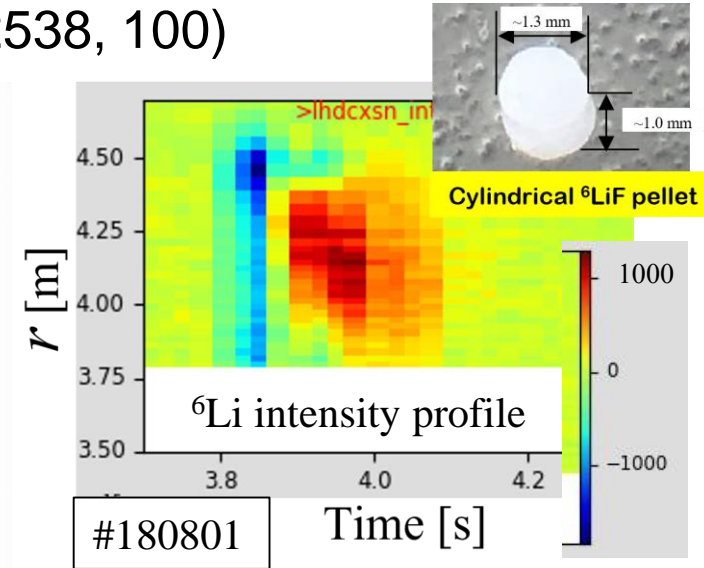
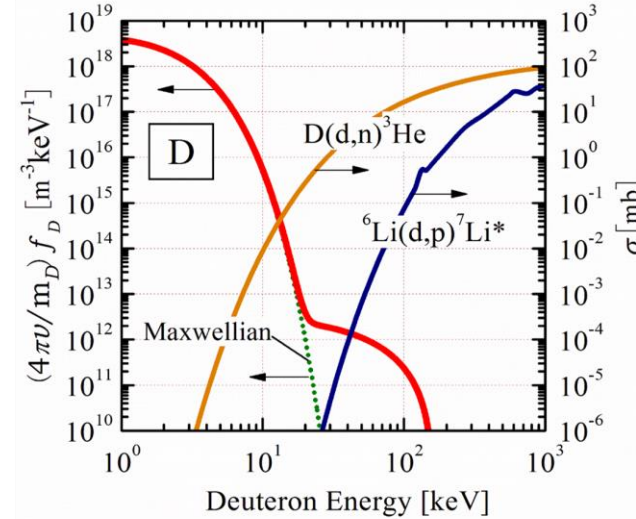
( #180800 - #180855)

## Background and motivation:

Observation of a knock-on tail using the  ${}^6\text{Li}(d,p\gamma){}^7\text{Li}$  gamma-ray generating reaction was carried out to understand slowing-down properties of fast ions due to nuclear elastic scattering.

## Results:

- At 3.8 s after the beginning of plasma discharge, a  ${}^6\text{LiF}$  pellet was injected into a deuterium plasma with H (#NBI 1,2,3) beam heating.
- $\gamma$ -ray counts from 3.9 to 4.1 s from almost 20 shots were integrated.
- 0.48 MeV  $\gamma$ -rays which may be emitted from the  ${}^6\text{Li}(d,p\gamma){}^7\text{Li}$  reactions were measured; the knock-on tail formation was suggested.



# Study of Fast-Ion Stiffness in Alfvén-Eigenmode at Helical Device (S. Kamio)

Shot #:180914-1804945

Experimental conditions:  $(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6, \text{CCW}, 1.0, 1.2538, 100), (3.6, \text{CCW}, 0.75, 1.2538, 100)$   
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(2.3, 3.5, 3.2, 4.7, 0) MW

## Background and motivation:

- Experiments in the tokamak device showed that fast-ion profile becomes stiff above a critical threshold of fast-ion pressure gradient in the presence of multiple-AEs. In this experiment, we verify that the fast-ion profile stiffness occurs in helical devices.

## Results:

- We observed the fast-ion distribution with FIDA when tangential-NBI power was scanned in the LHD experiment in 1.0 T and 0.75 T.
- FIDA intensity increases with NBI#4 modulation, which can be seen in Fig. 1.

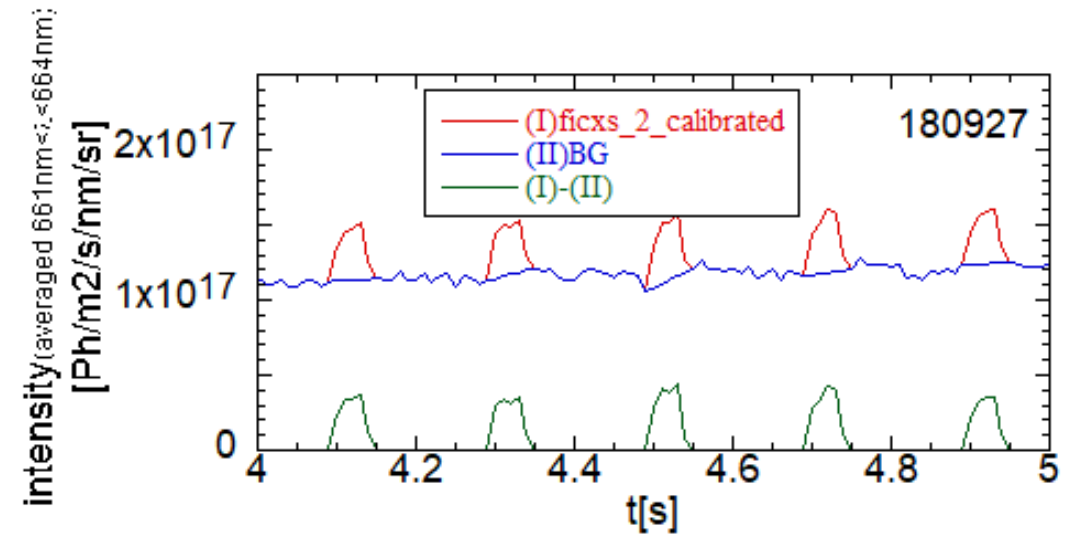


Fig.1 Time evolution of FIDA signal.