# (Special, MAP) Session Report

Mar. 22, 2024 (G. Motojima)

Date: Mar. 21, 2024
Time: 10:41 – 14:26
Shot#: 187893 – 187968 (76 shots)
Prior wall conditioning: None
Divertor pump: On
Gas puff: $H_2$, Ar
Pellet: TESPEL

NBI#(1, 2, 3, 4, 5) = gas(H, H, H, H, H)=P(3.8, 3.8, 4.0, 3.6, 2.8) MW
ECH(77GHz) = ant(1.5-Uo, 5.5-U, 2-OUR)=P(0.689, 0.38, -) MW
ECH(154GHz) = ant(2-OLL, 2-OUL, 2-OLR)=P(0.705, -, -) MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.7, 0.61, 0.62, 0.7)MW

Topics

1. ECH/ICH Commissioning (R. Yanai, T. Seki) will be reported next week.
2. Impurity behaviour study with triple TESPEL injection (M. Kubkowska(IPPLM), N. Tamura)

# Impurity behaviour study in LHD plasmas in experiment with triple TESPEL injection (M. Kubkowska, N. Tamura, M. Gruca, Ch. Suzuki et al.)

**Magnetic configuration**: ($R_{ax}$, Polarity, $B_t$, γ, $B_q$) = (3.60 m, CCW, 2.75 T, 1.2538, 100.0%)
**Shots**: #187926 - #187965

## Background

- In the recent LHD experiment, a successful TESPELs with Ti/V/Mn, Fe/Ni/Cu injection was obtained for an electron density of 1 – 5 $\times 10^{19}$ $m^{-3}$. In some cases for higher density experiment was not conducted or the plasma was collapsed. The main aim of this experiment is to obtain the data by using TESPELs containing Ca ($CaAl_2O_4$), Si ($SiB_6$) and Cu to complete the data obtained in the last experimental campaigns and for comparison with the future results in W7-X. The injection of Si(14)/Ca(20)/Cu(29) elements allowed to study impurity behaviour in various plasma conditions. Calcium has not been injected yet into the W7-X plasma, it will be interesting to study its behaviour at LHD, to properly prepare the experiment at the W7-X.

## Objectives

- Estimate the impurity decay time based on the line intensity evolution for injected elements
- Estimate the impurity decay time based on the line intensity evolution for various electron density of plasma (1-5E19).
- The identification of the spectra will be supported by the simulations using Flexible AtomicCode (using the Collisional-Radiative CR model).

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## Results

- **TESPELs are successfully injected** into the ECR-heated LHD H plasmas with $n_e$ up to 4.5E19 $m^{-3}$
- Density scan was possible to achived

| Element ¥ $n_e$ | 1.5E19 | 2.5E19 | 4.5E19 |
|---|---|---|---|
| $CaAl_2O_4$ | ✓ | ✓ | ✓ |
| $SiB_6$ | ✓ | ✓ | ✓ |
| Cu | ✓ | ✓ | ✓ |

- Emission lines from Si(14)/Ca(20)/Cu(29) have been observed clearly, Ca Be- and Li-like lines, Si Li-like line and Cu Mg- and Na-lines → To be analyzed

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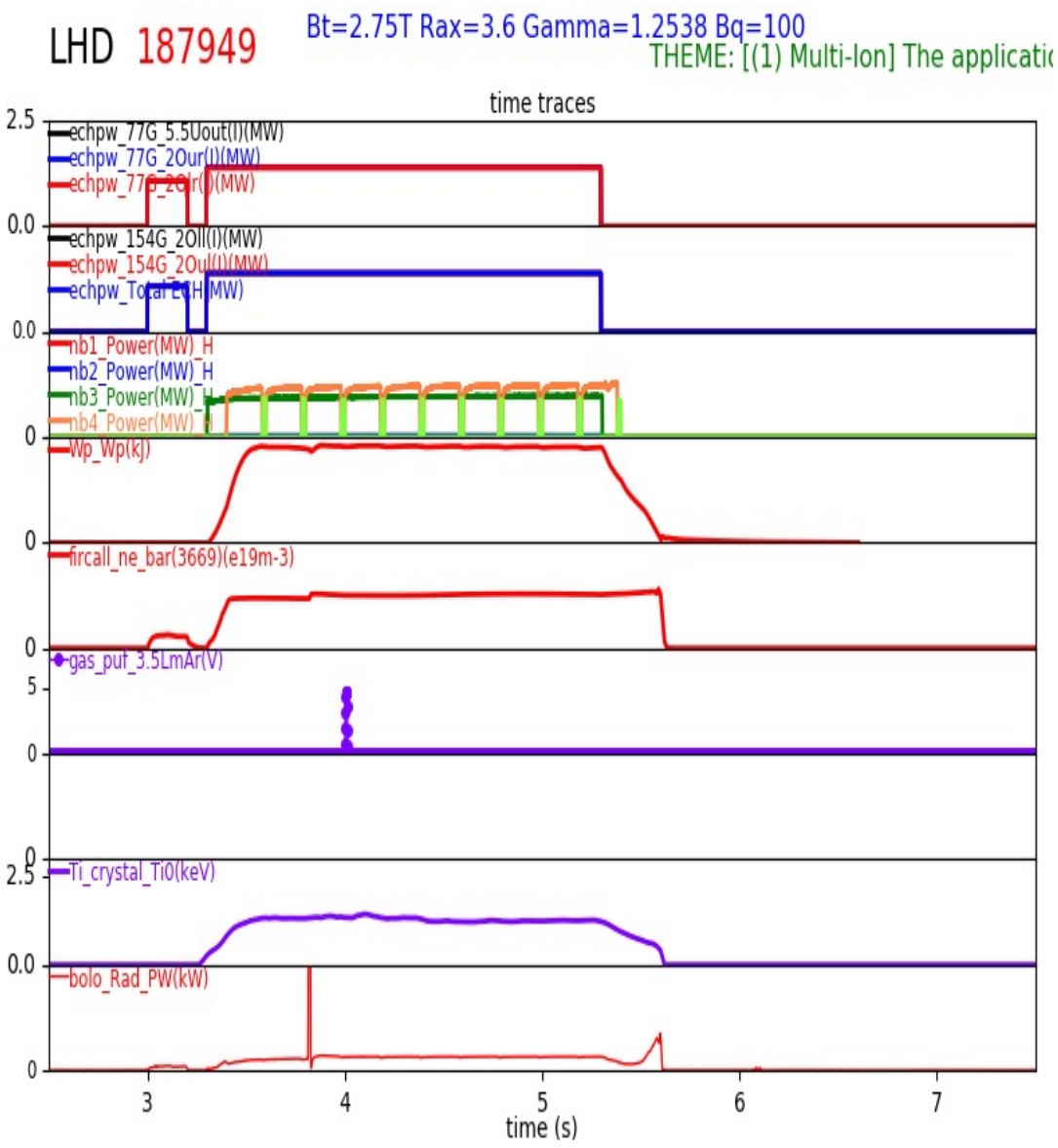
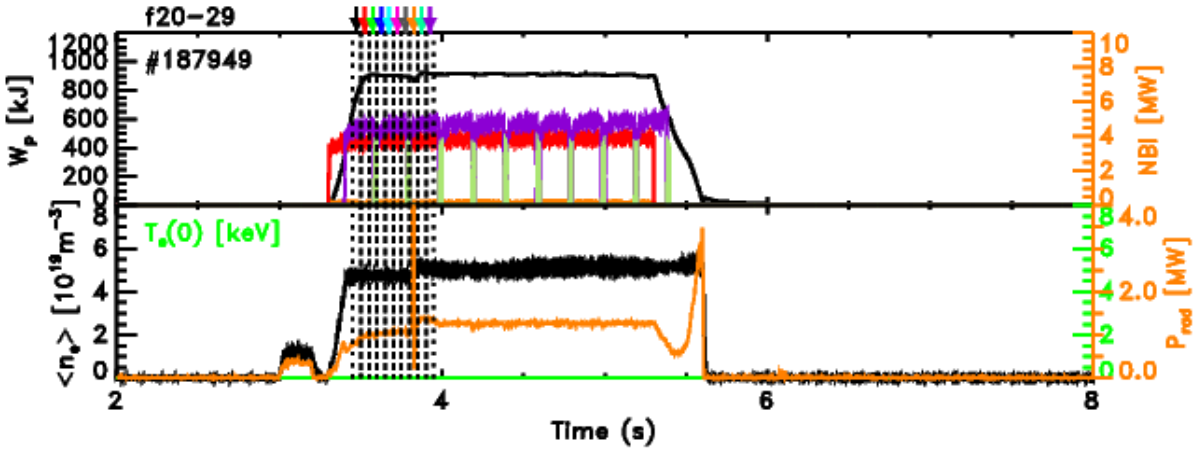
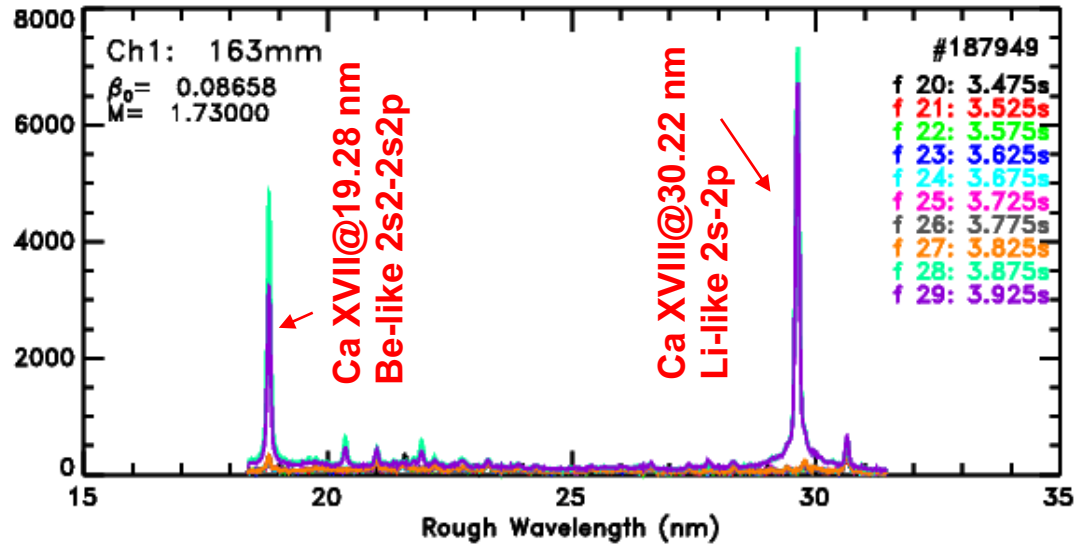



In the experiment **with $CaAl_2O_4$ injection**, Ca Be- and Li-like spectral lines are clearly observed in SOXMOS data



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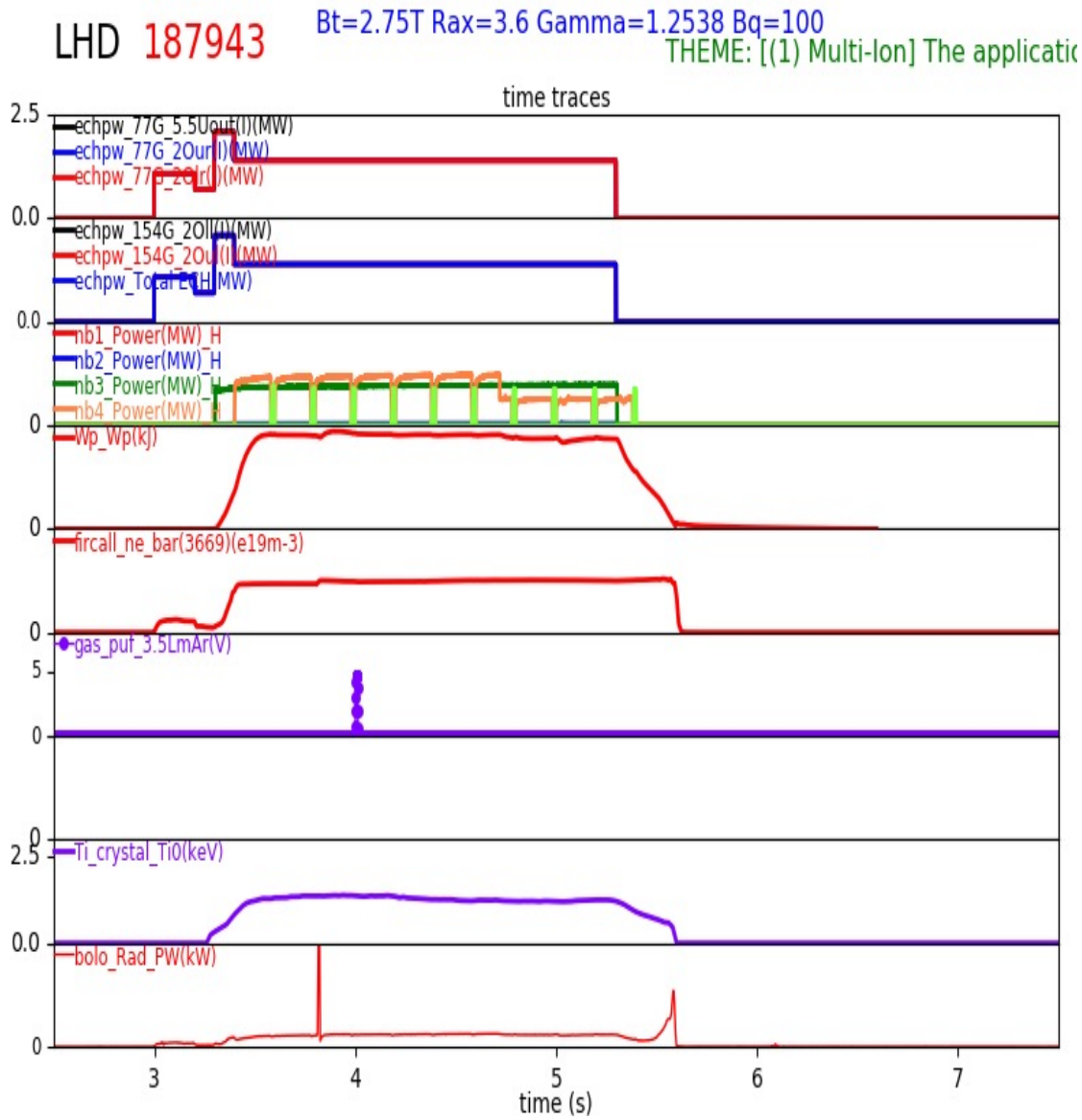
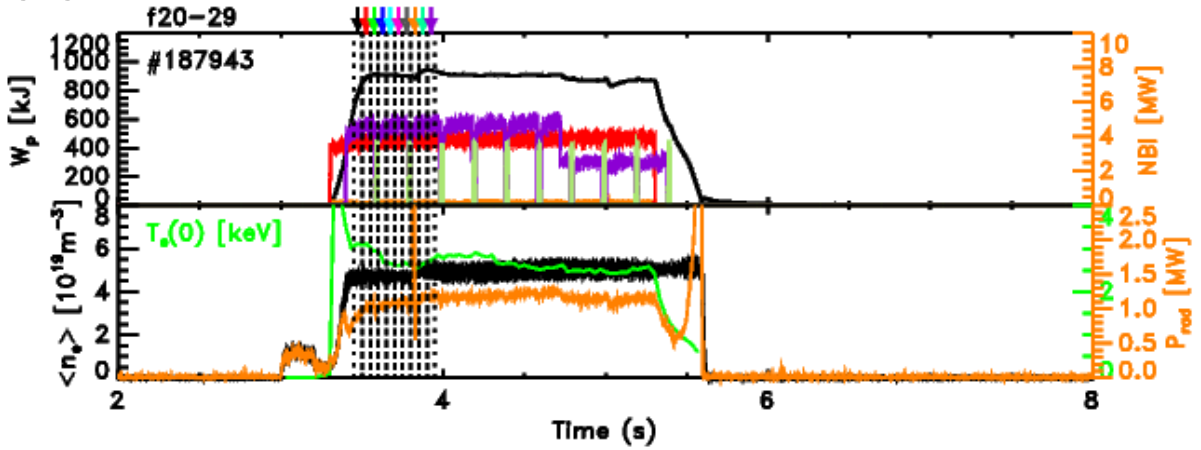
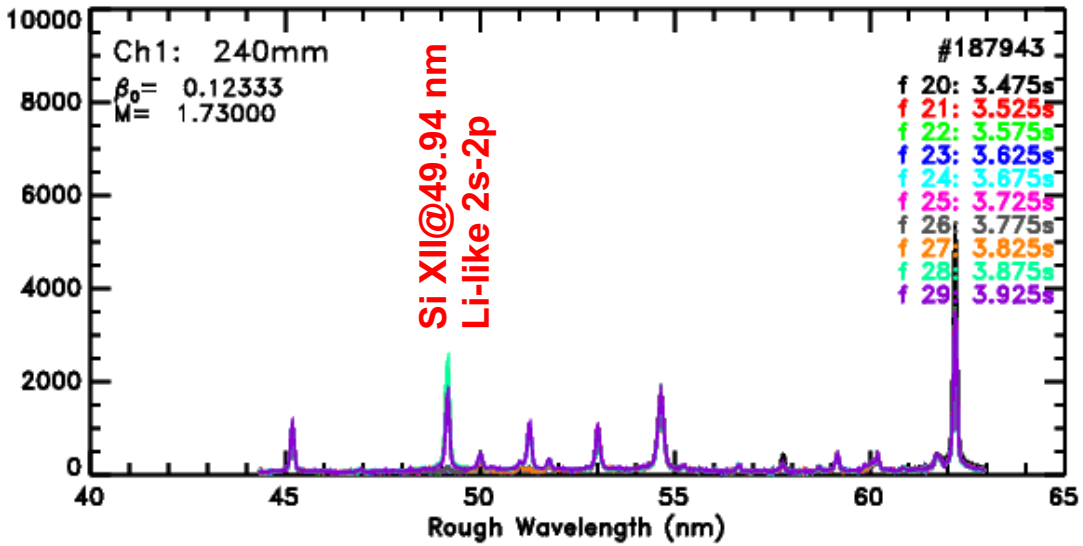



In the experiment **with $SiB_6$ injection**, Si Be- and Li-like spectral lines are clearly observed in SOXMOS data



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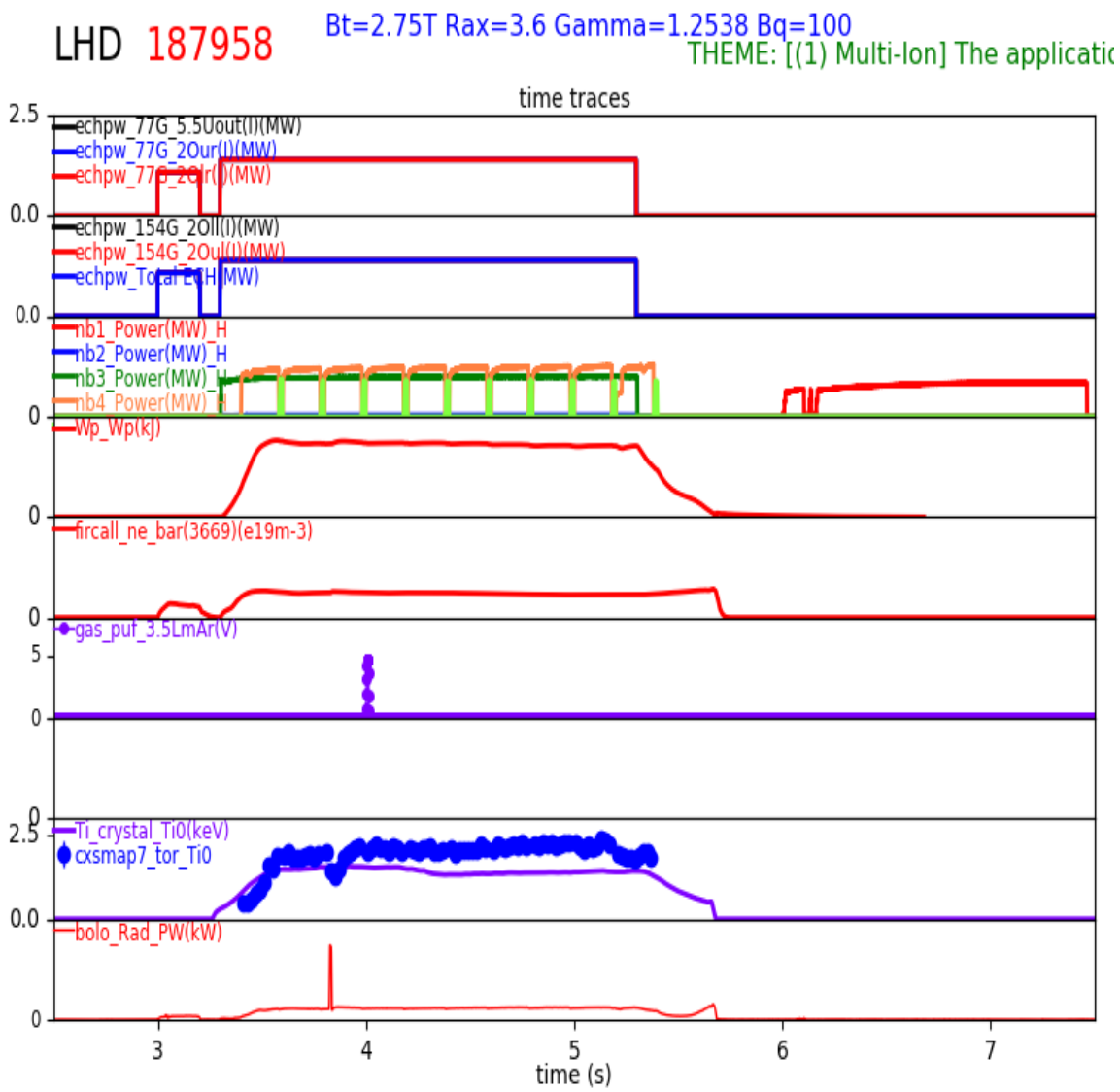


In the experiment **with Cu injection**, Cu Be- and Na-like spectral lines are clearly observed in SOXMOS data