

Daily Report for 2025-10-09

N. Kenmochi

Date: October 9, 2025

Time: 10:00 – 17:15

Shot: 194690 – 194821 (131 shots)

Prior wall conditioning: No

Divertor pump: No

Gas puff: H₂, N₂, Ne, Ar, Kr

Pellet: Impurity pellet (W)

LID: Yes

NBI: #1, #2(one ion source filament has broken), #3, #4, #5

ECH: 5.5-UO (77GHz), 2-OUR (77GHz), 2-OUL (154GHz), 2-OLL (154GHz)

ICH: 4.5 U, L (Comissioning)

Topics

1. Polarization imaging of Ar XIV and H α emission lines for diagnosing anisotropic electron velocity distributions(T. shikama, M. Goto)
2. Experimental study of electron temperature anisotropy and non-Maxwellian distribution of electrons by using the LHD Thomson scattering system(I. Yamada)
3. Prediction and control of radiative collapse using a decision model(Y. Suzuki)
4. Density limit relation to edge turbulence(G. Motojima)
5. Exploration of line emissions from tungsten ions in low charge states and the application to the study of impurity transport in the edge plasmas (R. Nishimura, I. Murakami)
6. Simultaneous multiwavelength spectroscopies for validation on atomic data and spectroscopic modeling for highly charged ions(I. Murakami)

Polarization imaging of Ar XIV and H α emission lines for diagnosing anisotropic electron velocity distributions

T. Shikama (Kyoto Univ.)
and M. Goto

Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$
#194690 - #194710

Motivation and method:

- To investigate anisotropy of electron velocity distribution in core plasma.
- Polarization modulation imaging and spectroscopy of Ar XIV M1 emission line

Results:

- High-speed camera did not operate due to magnetic field effect, even though shield was installed (it was likely insufficient).
→ Shield will be reinforced before next machine time 10/21.
- Spatial and temporal distributions of intensity were evaluated.
→ Gas puff amount will be optimized.

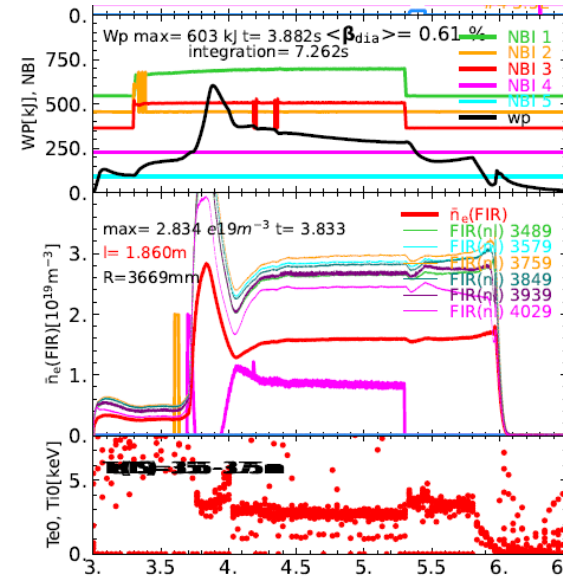


Fig.1 #194703

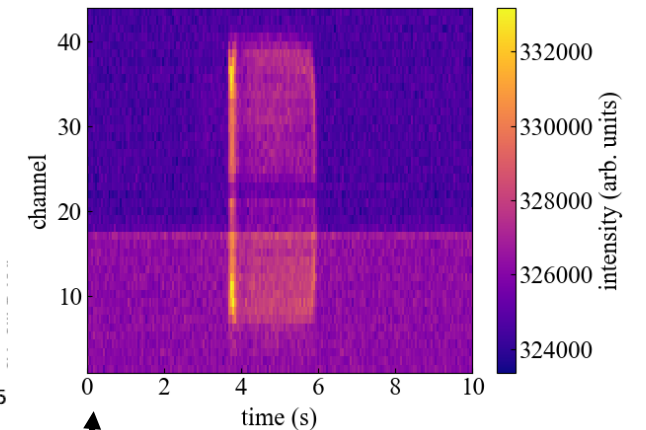


Fig. 3 Ar XIV intensity

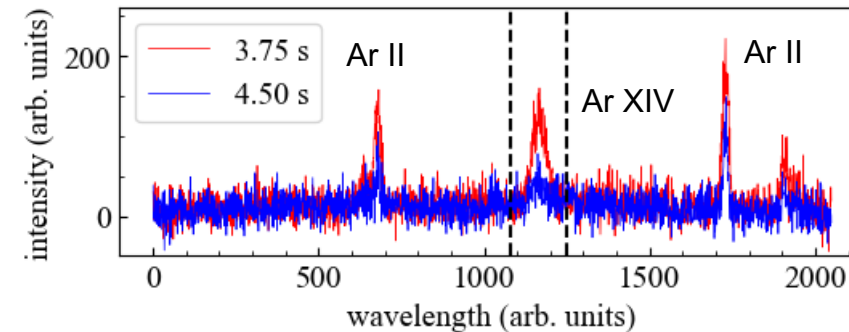


Fig.2 Ar XIV spectrum (100, ch10)

Experimental study of Electron Temperature Anisotropy and non-Maxwellian Distribution of Electrons by using the LHD Thomson scattering system

I. Yamada, H. Funaba, T. Tokuzawa, E. Yatsuka (QST), J. H. Lee (KFE), C. Lee (SWIP), Y. Huang (SWIP)

Experimental conditions:

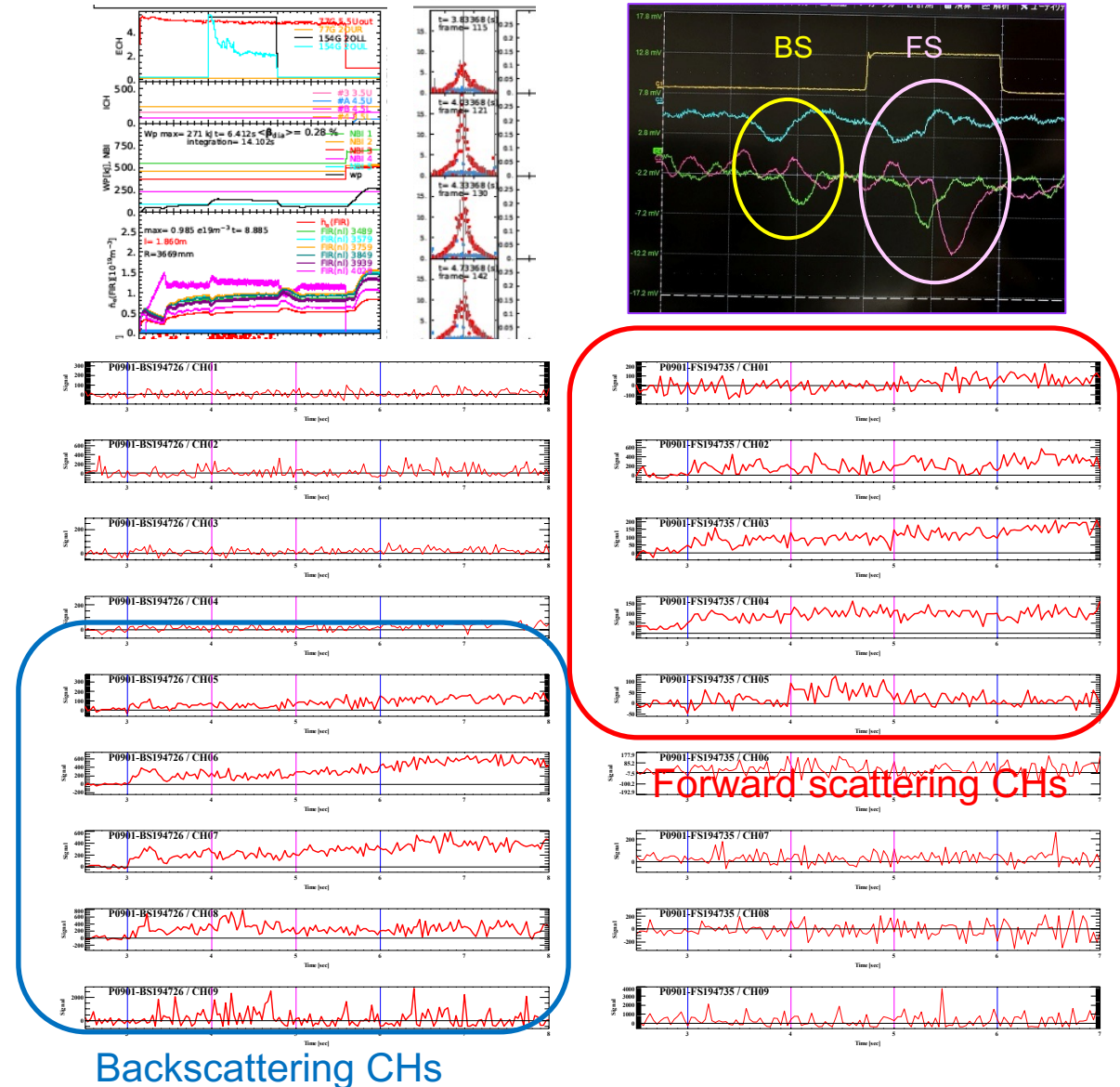
$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$
#194711 - #194738 (28), Fixed discharge: #194722 - #194738
 $T_{e0} \sim 13 \text{ keV}, n_e \sim 0.5 \times 10^{19} \text{ m}^{-3}$

Motivation and method:

- 9-CH polychromator optimized for the study of Electron Temperature Anisotropy .
- 12-CH polychromator optimized for the study of non-Maxwellian Distribution of Electrons.

Results:

- Both backscattering Thomson signal (T_e^{perp}) and forward scattering Thomson signal (T_e^{para}) were measured by a 9-CH polychromator.
- T_e^{perp} and T_e^{para} will be obtained after a few revisions of data analysis program.



Prediction and control of radiative collapse using a decision tree model.

T. Shibata, Y. Suzuki, N. Kenmochi, M. Yokoyama

Experimental conditions:

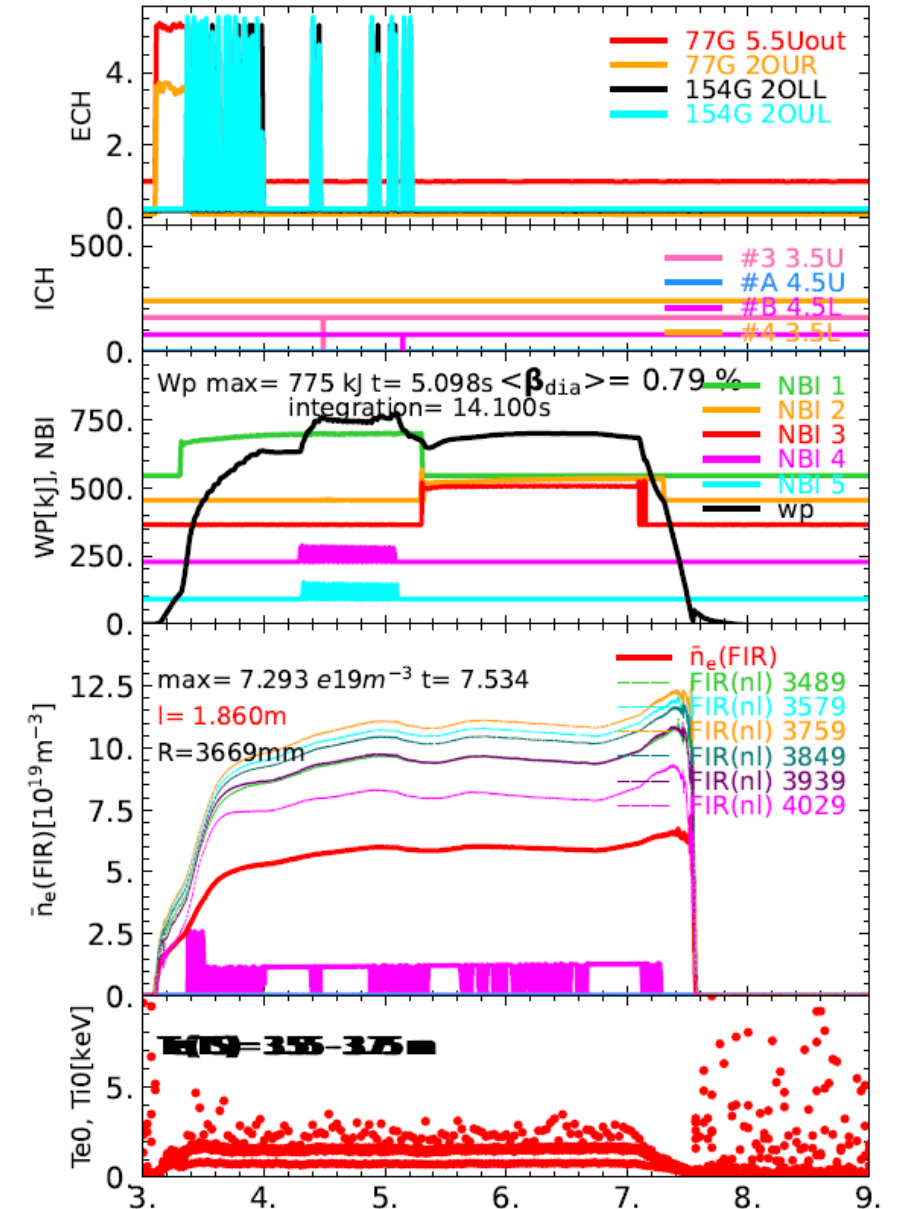
$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$
#194746 - #194762

Motivation and method:

- This experiment demonstrates the effectiveness of a data-driven approach for plasma control.
- Control gas puffing and additional ECH from signal of ECE measurement and VUV spectroscopy. Time Series Forest Classifier predicts collapse 100ms in advance from measured values.
- Increased control signal pulse width compared to October 7 experiments (10ms \rightarrow 25ms)

Results:

- Under conditions expected to cause radiative collapse, the control system successfully maintained stable plasma in multiple shots.
- Comparison of control methods showed that gas puff control was more effective than ECH control alone in maintaining plasma stability.
- For ECH control, heating the plasma edge region ($\rho=0.8$) was more effective at suppressing radiative collapse than heating the core region ($\rho=0.4$).



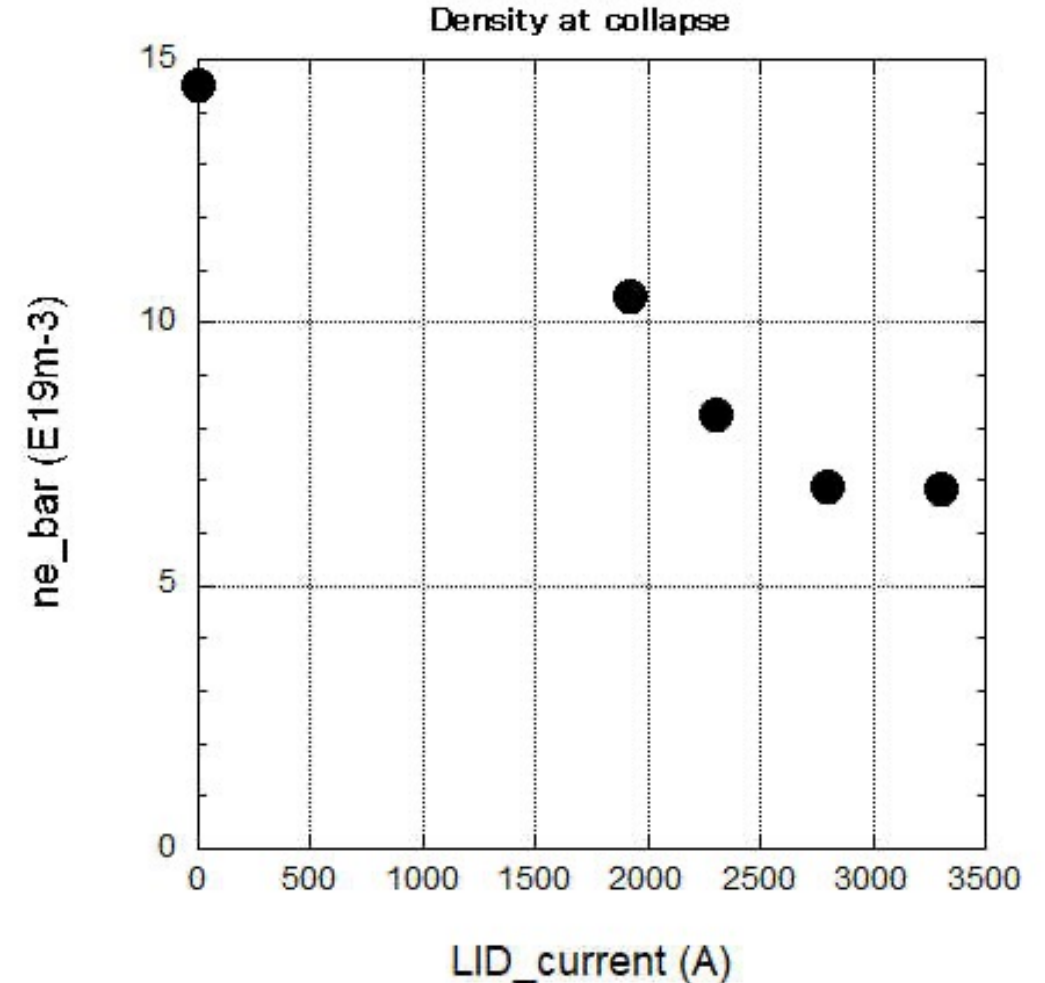
Relation between density limit and edge turbulence



G. Motojima and T. Morisaki, Oct. 9, 2025

shot#: 194763 - 194783 ($R_{ax}=3.85\text{m}$, $B_t=2.57\text{T}$, $\gamma=1.254$)

- Objective:
 - Investigate effect of edge turbulence on density limit, changing the edge pressure gradient by RMP
 - Accumulate data at $R_{ax}=3.85\text{m}$ (3.75m obtained last year)
- Experiment:
 - Decide the reference shot, #194765 w/o LID
 - Apply RMP during discharge, changing amplitude shot by shot
 - Define density limit at a time when n_e , P_{rad} increase abruptly and/or W_{dia} rollovers
- Results
 - Density limit decreases as RMP increases, similar to the case at $R_{ax}=3.75\text{m}$
 - Turbulence analyses will be performed



Exploration of line emissions from tungsten ions in low charge states and the application to the study of impurity transport in the edge plasmas.

R. Nishimura, T. Oishi (Tohoku Univ.) and I. Murakami

Experimental conditions:

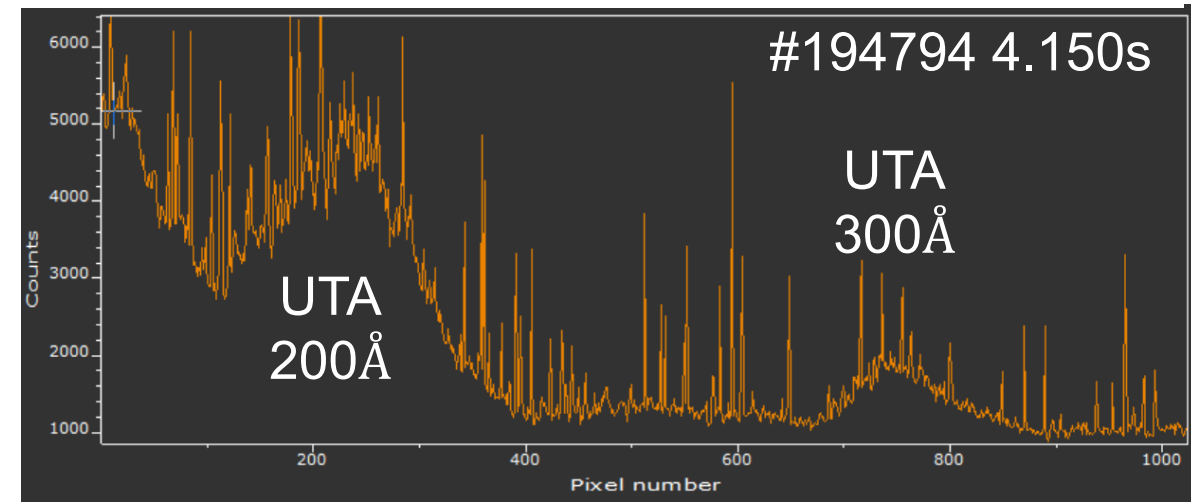
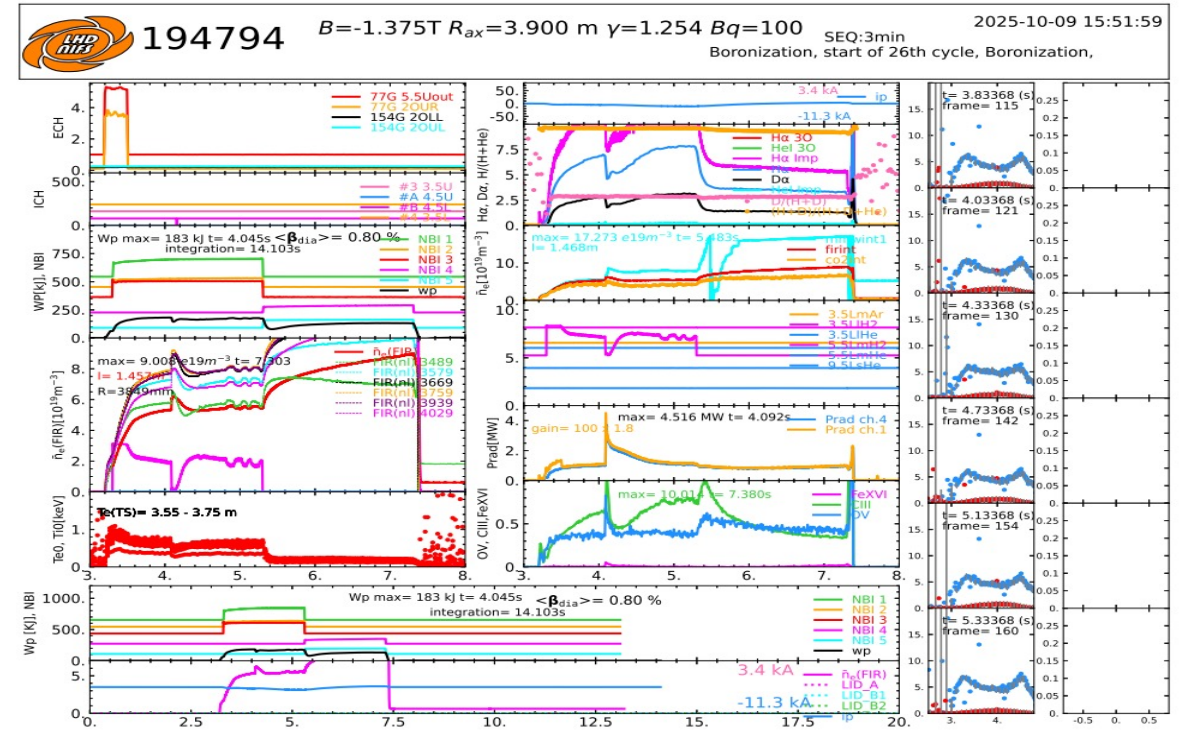
$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.9 \text{ m}, \text{CCW}, 1.375 \text{ T}, 1.2538, 100.0\%)$
 #194785 - #194803

Motivation and method:

- Spectral data of tungsten ions in low charge states is necessary for impurity transport study in the edge plasmas.
- Tungsten pellet is injected into the plasma with $T_{e0} \sim 1 \text{ keV}$. Unresolved Transition Array (UTA) spectra, as well as discrete line spectra, are observed.

Results:

- Two UTAs around 200\AA and 300\AA were clearly observed by “EUV Long” spectrometer.
- Space-resolve spectra around $160\text{-}210\text{\AA}$, and $280\text{-}340\text{\AA}$ were taken in #194785 ~ #194794, and #194795 ~ #194803, respectively.



Simultaneous multi-wavelength spectroscopies for validation on atomic data and spectroscopic modelling for highly charged ions

Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.9 \text{ m}, \text{CCW}, 1.375 \text{ T}, 1.2538, 100.0\%)$

#194804 - #194821

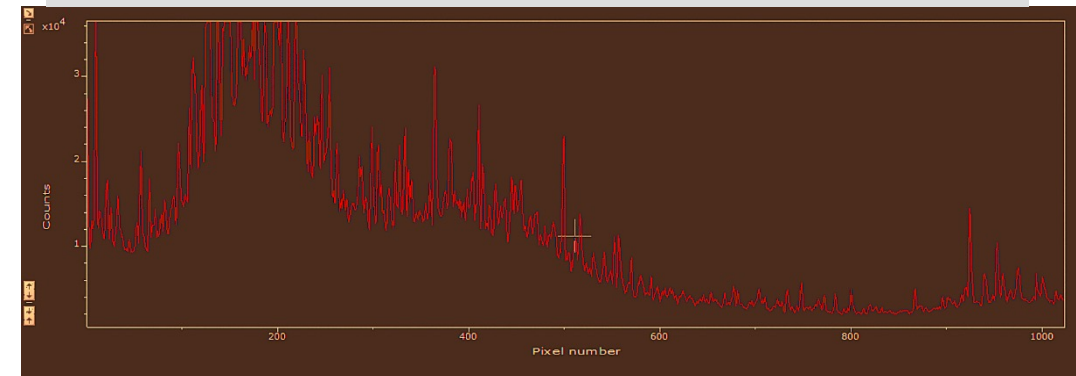
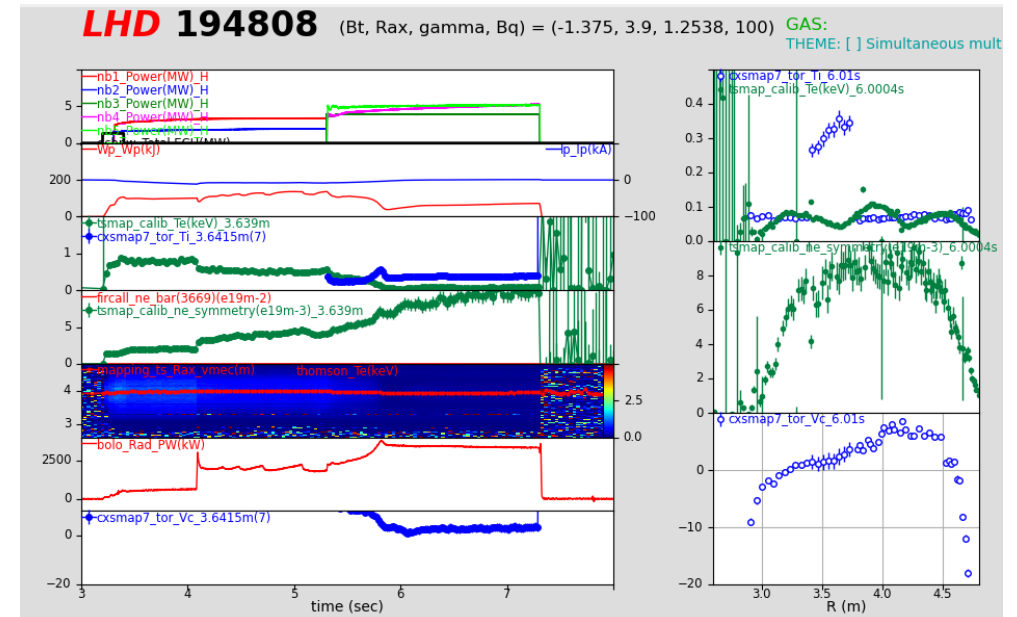
Motivation and method:

- Spectra of mid to low charged tungsten ions are required for investigating tungsten behavior in plasmas and validating collisional-radiative (CR) models for tungsten ions. A W pellet was injected at 4.1 s.
- Kr spectra are required to validate atomic data and collisional-radiative models for Kr ions. Also the effect of mixture of Kr and Ne puff to plasmas are interested in.

Results:

- Low temperature plasmas with $T_e \sim 0.1 \text{ keV}$ were kept with accumulated tungsten. Measured EUV spectra are expected to be one of W^{q+} ions with $q \sim 7-15$ probably. We need CR models to check.
- Kr and Ne emission lines may be measured, but we need to analyze spectra carefully.

I. Murakami, S. Gupta (Natl. Cheng Kung U., Taiwan), and T. Oishi (Tohoku U.)



W spectrum for $\lambda \sim 15-36 \text{ nm}$ at $t=6.0 \text{ s}$ (#194808)