# Measurement of collective Thomson scattering for electron and ion features on SNU X-pinch device

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A collective Thomson scattering (CTS) diagnostic system has been developed to measure the electron and ion features of the jet plasma region of X-pinch plasma (electron temperature, ion temperature, electron density, average charge state, plasma bulk velocity) on the SNU X-pinch device [1, 2]. Due to the characteristic of CTS, depending on the ion motion, a signal with two peaks in a very narrow wavelength range is observed. To analyze CTS signals, a spectrometer with a high dispersion and high resolution is required. The spectrometer had been designed and installed to have a dispersion of 0.004 nm/pixel. The stray light of the laser wavelength (532 nm) need to be carefully blocked to minimize the loss of the CTS spectrum. Therefore, a volume Bragg grating narrow notch filter (optical density of 4) has been installed at the entrance of the spectrometer to block stray light. For the fine tuning of the optical alignment and for the spectral calibration, the rotational Raman scattering spectrum was measured under atmospheric conditions ($N_2$ of 78%, $O_2$ of 21%). The spectral resolution including instrumental broadening, was measured using a continuous wave laser with wavelength of 532 nm passed through neutral density filters. The full width of half maximum is 0.0813 nm. The CTS signal from the jet region of the X-pinch plasma was successfully measured through the developed system. The theoretical CTS spectral density function convolved with the spectral resolution was compared to the measured CTS signal, and the electron and ion characteristics were analyzed quantitatively.

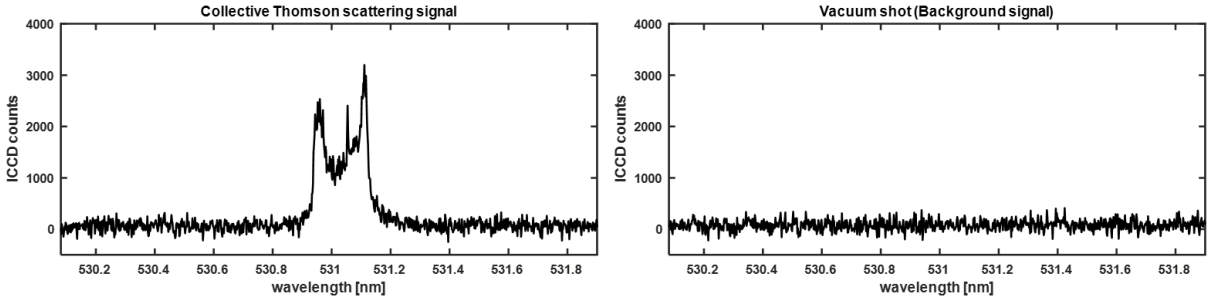


Figure 1. (left) The collective Thomson scattering signal measured at the jet region of the X-pinch plasma. (right) The background signal captured without plasma.

[1] Jonghyeon Ryu, *et al.*, Rev. Sci. Instrum.**92** (2021) 053533.

[2] Jongmin Lee, *et al.*, J. Instrum.**18.12** (2023) C12004.

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