Investigation of Laser-Produced Plasmas During the Irradiation Using Collective Thomson Scattering

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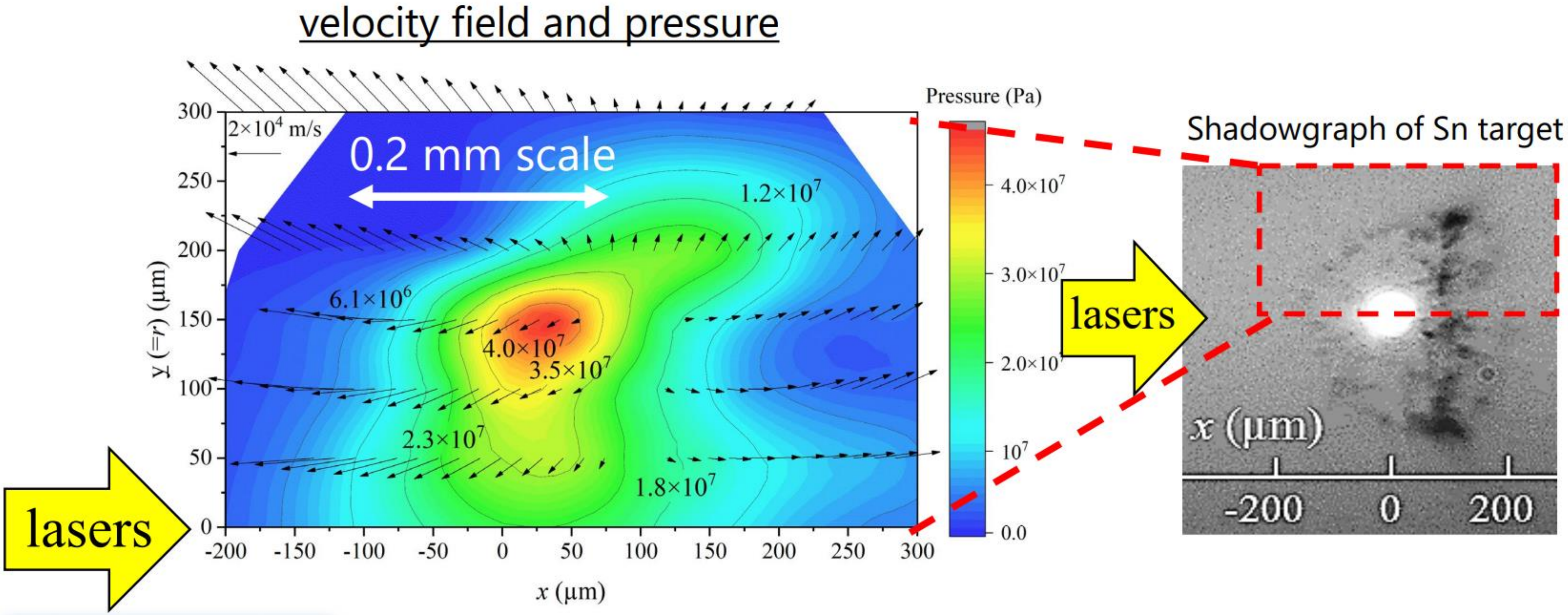
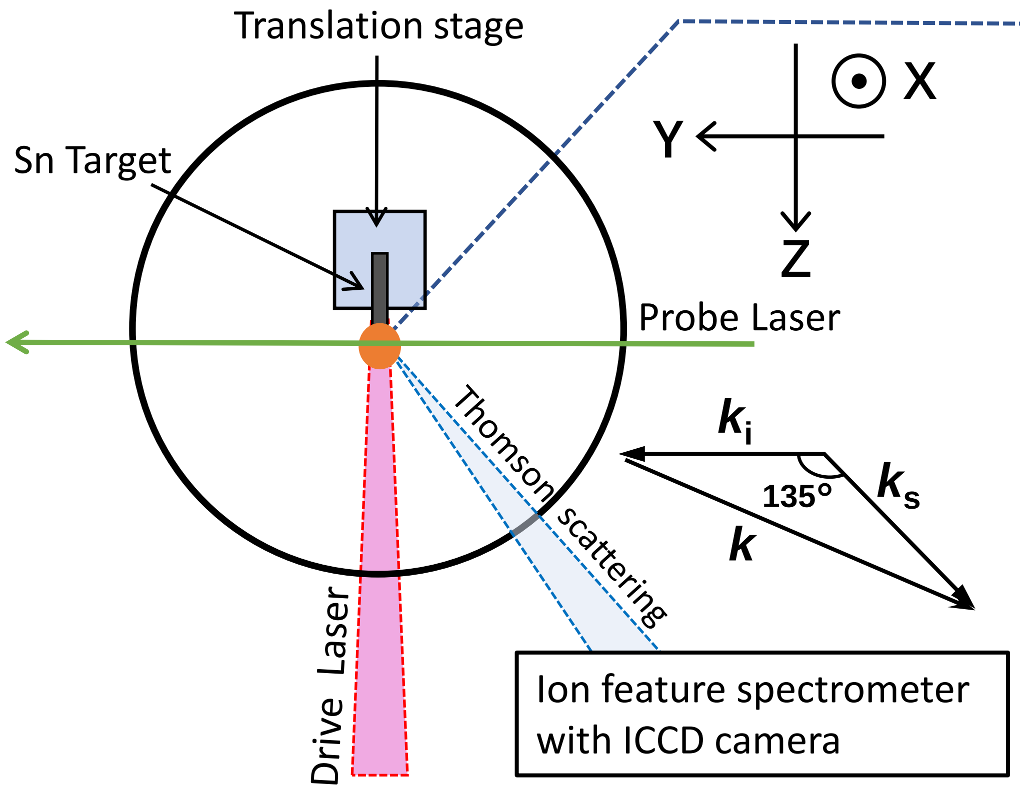
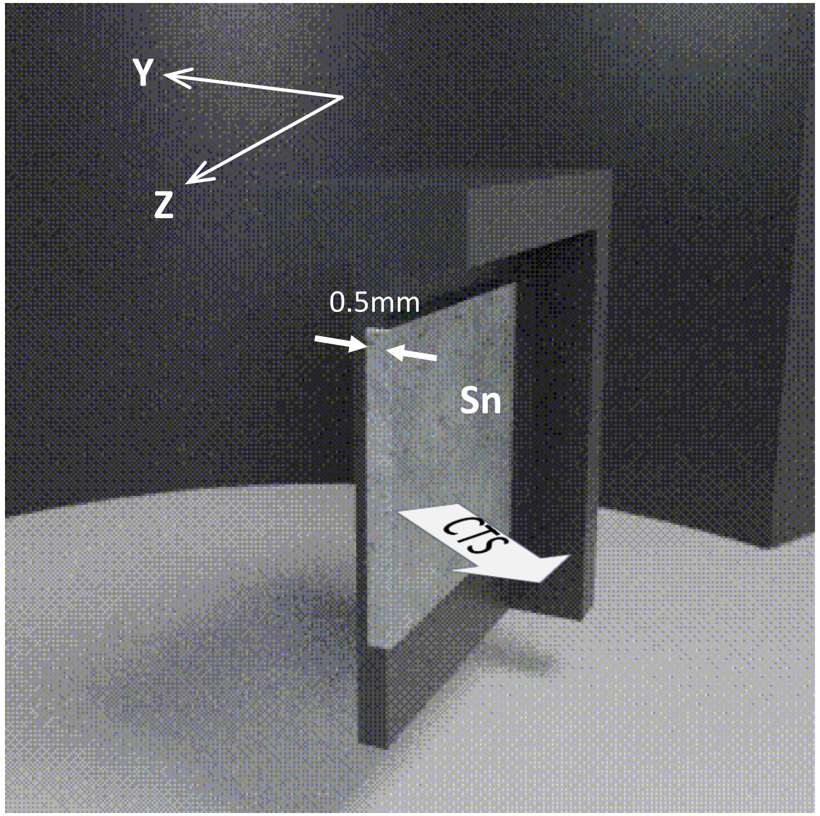
Dr. Tomita's talk:

- Collective Thomson scattering (CTS) is a powerful method to diagnose **CO_2 laser + droplet** plasma



Ion feature of collective Thomson scattering: Experimental setup



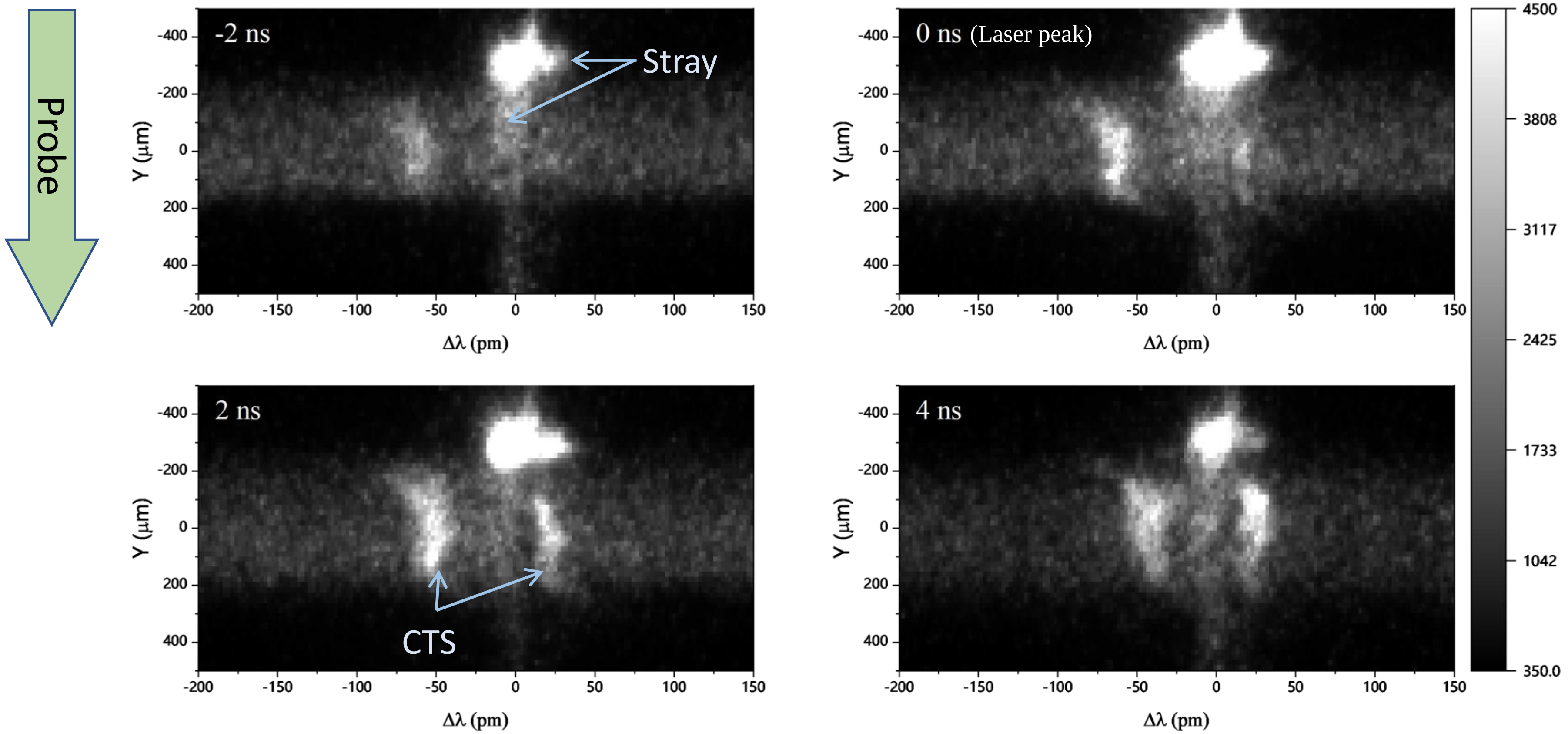


Nd:YAG	Probe	Drive
Wavelength	532 nm	1064 nm
Pulse width	4 ns	7 ns
Laser energy	4 mJ	200 mJ
Spot diameter (FWHM)	50 μm	650 μm

Measured space and time		
Space	Z = 0.13 to 0.4 mm	Y = -0.2 to 0.2 mm
Time	-2, 0, 2, 4 ns from the peak of drive laser	

Laser peak intensity: 6×10^9 W/cm^2

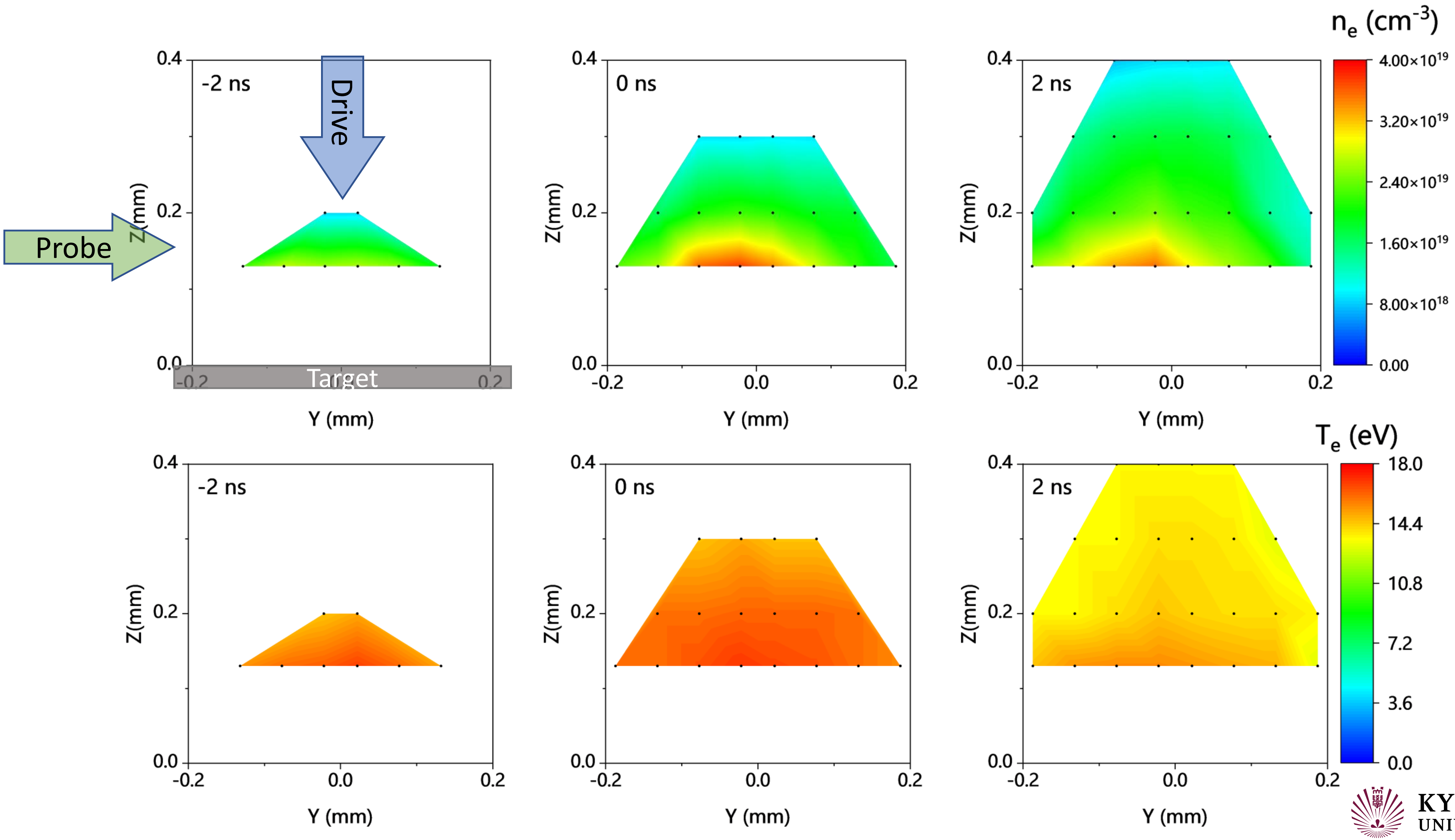
Time evolution of CTS spectra at 0.13 mm above target



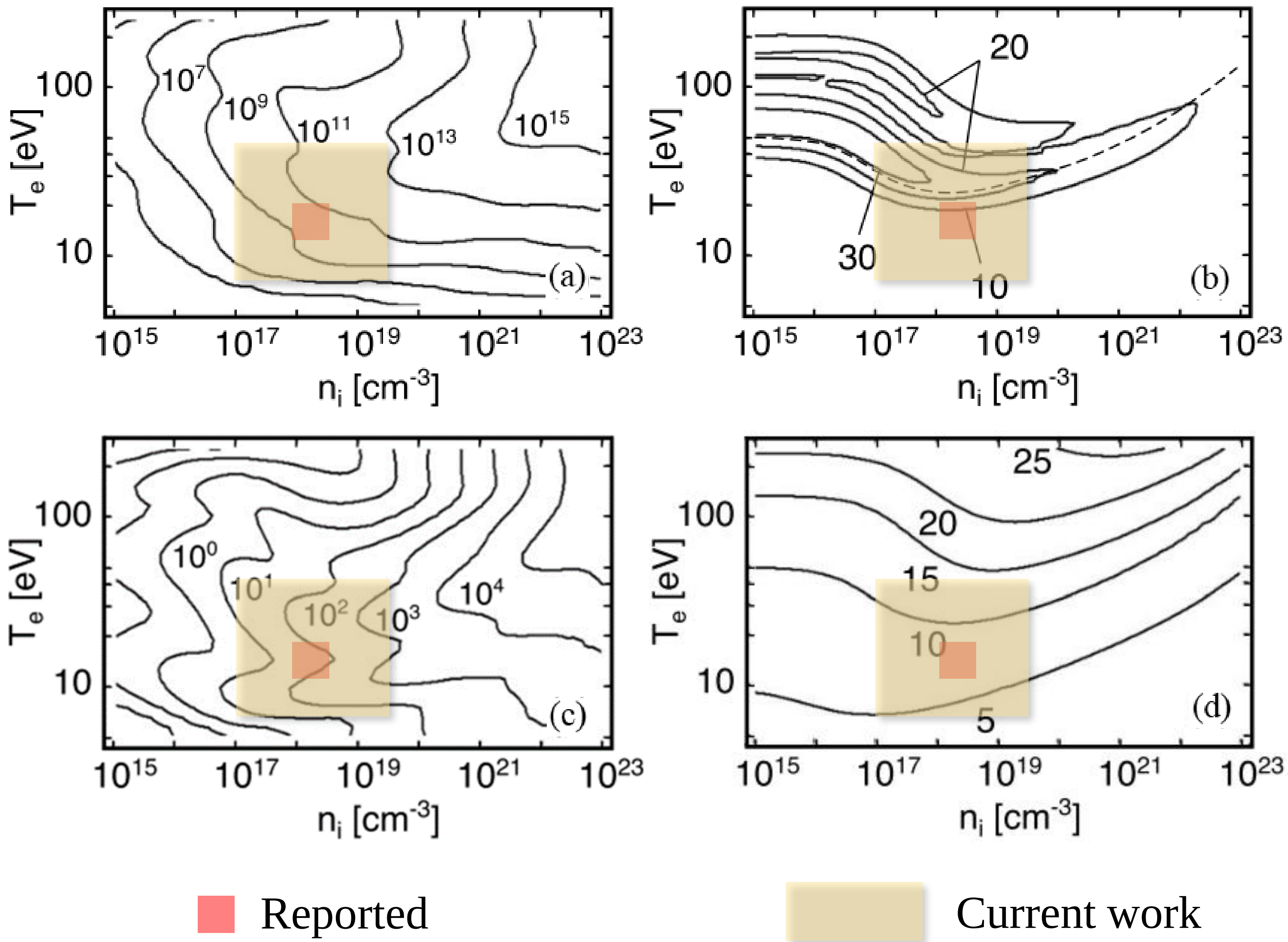
- Electron density $(n_e) \propto$ Intensity
- Electron temperature $(T_e) \propto \Delta\lambda_{\mathrm{peak}}$
- Ion drift velocity $(v_d) \propto$ Doppler shift

* Assume $T_e = T_i$,
* Ion charge Z_i from FLYCHK

Temporal resolved 2-D Sn plasma T_e and n_e profile, during the laser pulse



Measured Sn plasma parameter marked in Sasaki et al, JAP 2010, Fig. 15:

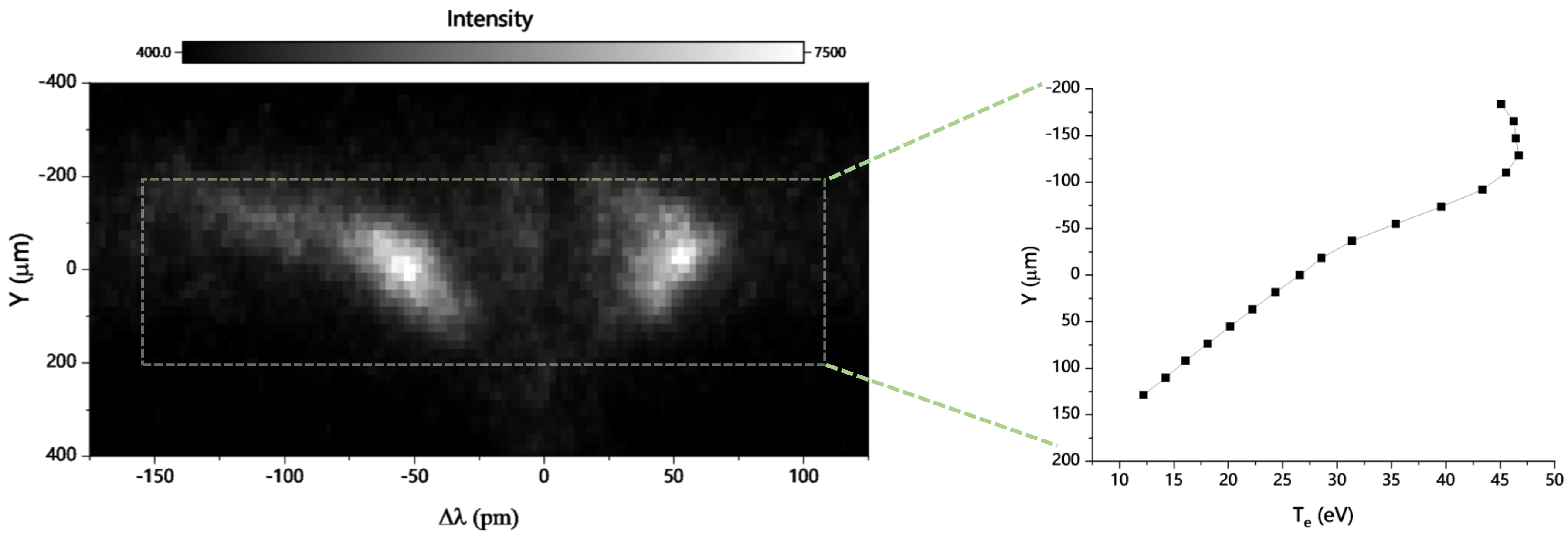


(a) in-band emissivity (W cm^{-3})
(b) spectral efficiency,
(c) in-band opacity (cm^{-1}),
(d) Mean charge

	Reported	Current
in-band emissivity (W cm^{-3})	~ 10^{10}	10^{10}-10^{11}
Spectral efficiency	~10%	10-20%
in-band opacity (cm^{-1})	~100	10-100
Mean charge	~ 8	11-13

Current work and Summary

YAG + solid target produced 20~50 eV Sn plasma



Summary

- CTS: feasible to **Nd:YAG(1.06 µm) + solid target** produced Sn plasma for EUV.
- Can be helpful to the fundamental EUV research and can benchmark simulations.