ディーゼル燃焼チーム クラスター大学(1)（グループ1）

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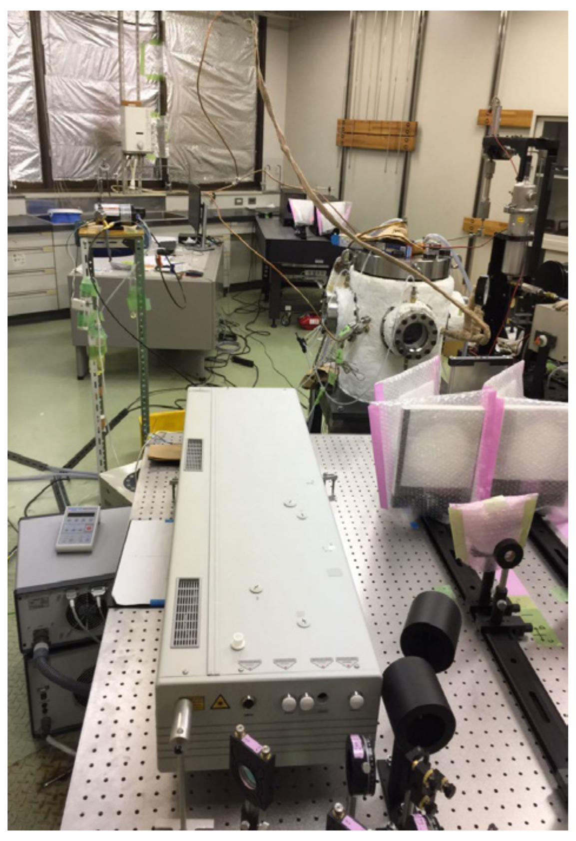
Quantitative Measurements of Spray Development and Mixture Formation

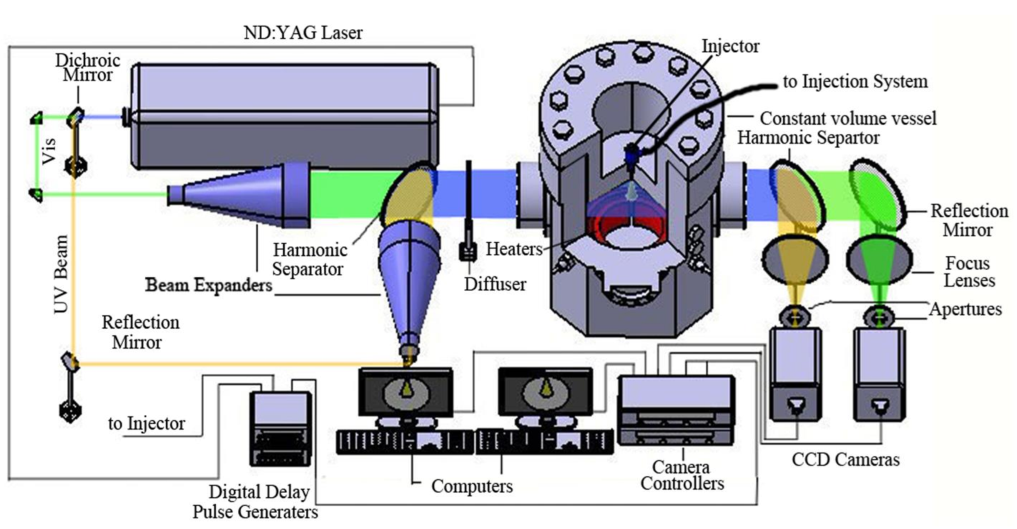
Research Objectives

- ✓ **Measure the liquid / vapor mass distribution of a diesel spray**
- ✓ **Correlate mixture formation with nozzle internal flow behaviors**
- ✓ **Provide mixture formation data for the validation of CFD models**

Methodologies

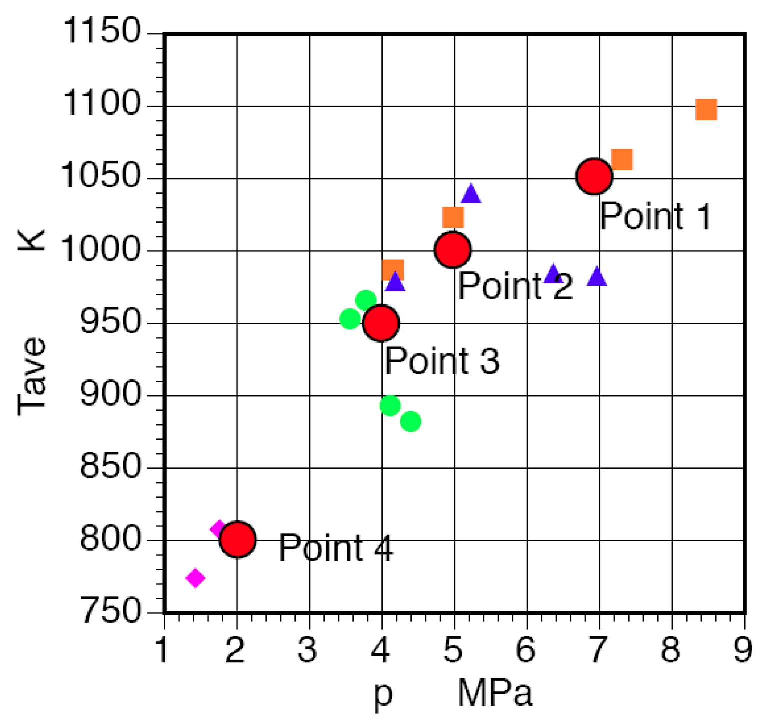
Optical experiments setup (tracer-LAS)





*LAS: Laser Absorption Scattering

Typical in-cylinder conditions for modern turbocharged diesel engines



Evaporating conditions

No.	p_{amb} [MPa]	T_{amb} [K]	ρ_{amb} [kg/m³]	p_{inj} [MPa]	Injection event	Q_{inj} [mg]
1	7	1050	23.27	50,100,150	main	2.5, 5.0
2	5	1000	17.45	50,100,150	main	1.0, 2.5
3	4	900	15.51	50,100,150	pilot	0.2, 0.5
4	2	800	8.72	50,100,150	early pilot	0.2, 0.5

Non-evaporating conditions

No.	p_{amb} [MPa]	T_{amb} [K]	ρ_{amb} [kg/m³]	p_{inj} [MPa]	Injection event	Q_{inj} [mg]
1	2.00	293	23.82	50,100,150	main	2.5,5.0
2	1.50	293	17.87	50,100,150	main	1.0,2.5
3	1.35	293	16.08	50,100,150	pilot	0.2, 0.5
4	0.75	293	8.93	50,100,150	early pilot	0.2, 0.5

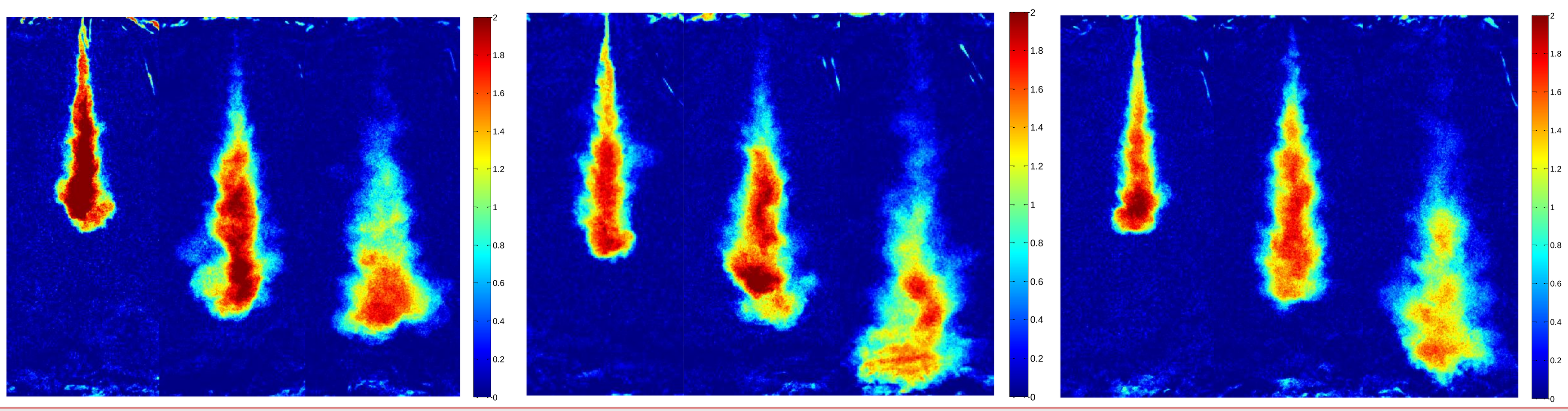
Main Results

Single-hole nozzle (ϕ0.123 x 1)

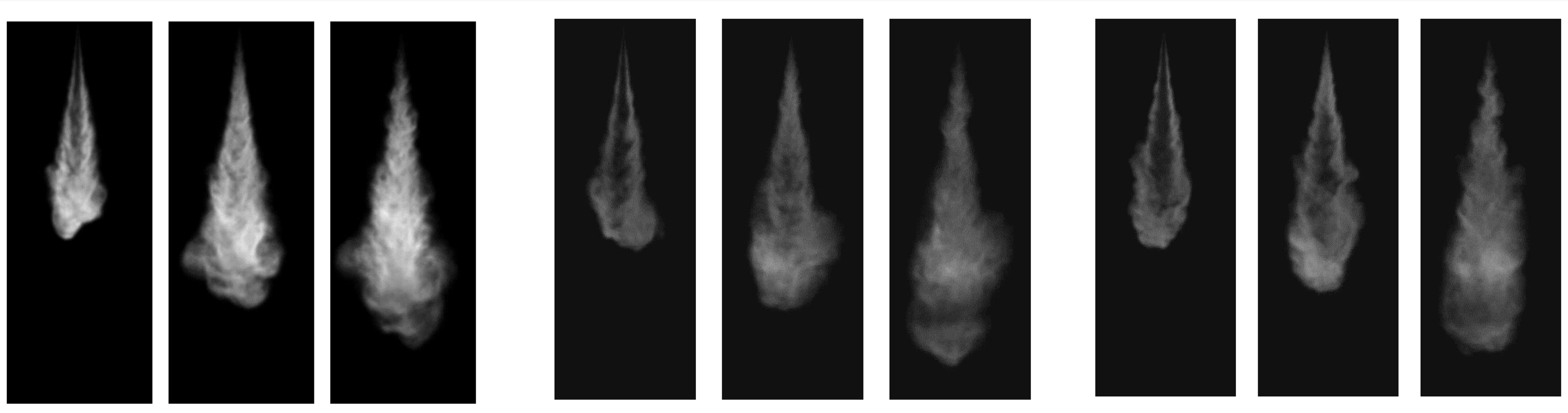
Experimental Conditions: ρ ≒ 17.45 kg/m³, p_{inj} = 50 MPa | ρ ≒ 17.45 kg/m³, p_{inj} = 100 MPa | ρ ≒ 17.45 kg/m³, p_{inj} = 150 MPa

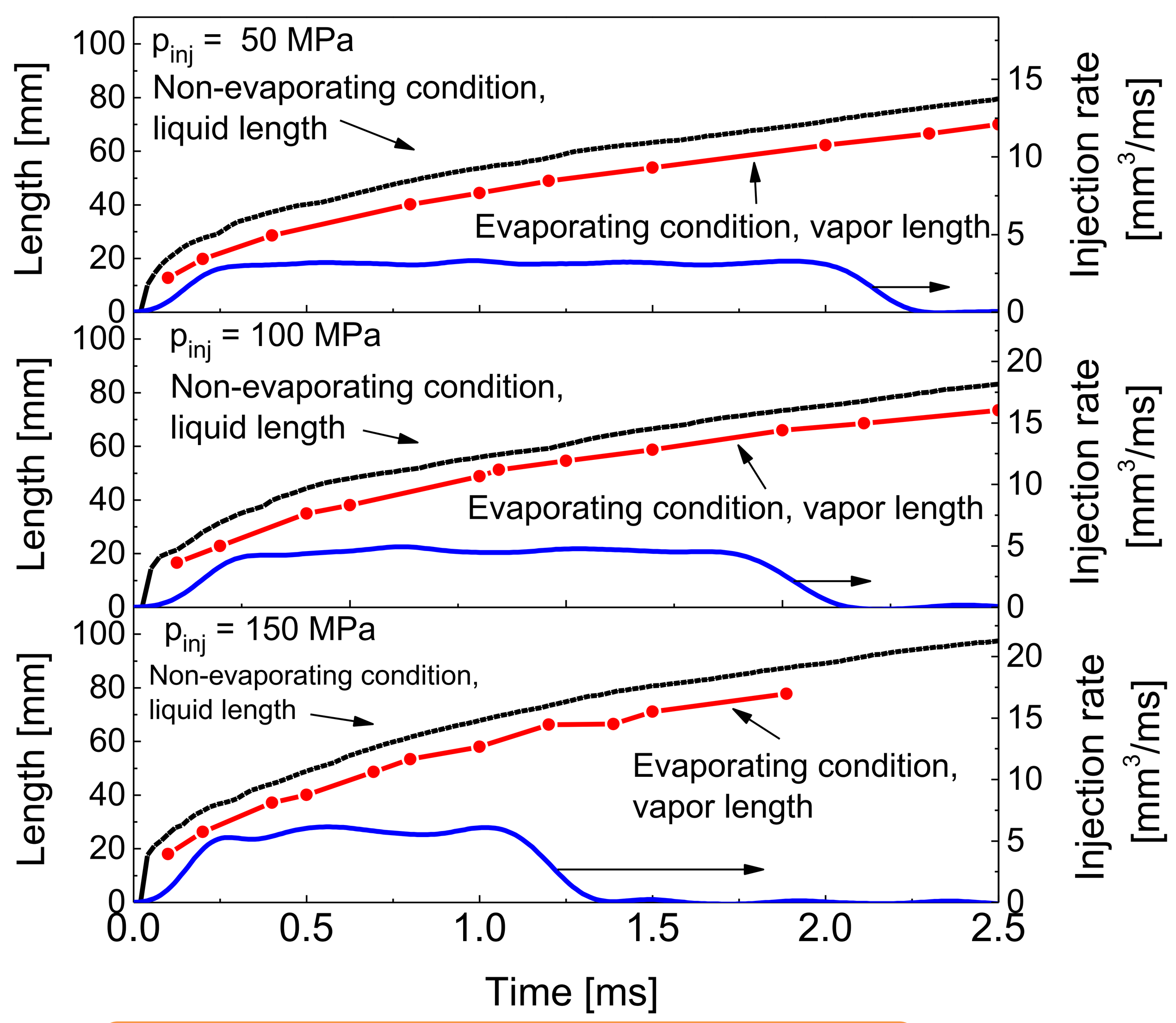
Time ASOI [ms]	EOI/2	EOI	EOIx1.5	EOI/2	EOI	EOIx1.5	EOI/2	EOI	EOIx1.5
	1.2	2.3	3.0	1.0	1.7	2.5	0.7	1.2	2.0

Evaporating conditions T_{amb} = 1000 K — Vapor phase (UV) using optical thickness $\log\left(\frac{I_0}{I_T}\right)_{\lambda_A}$



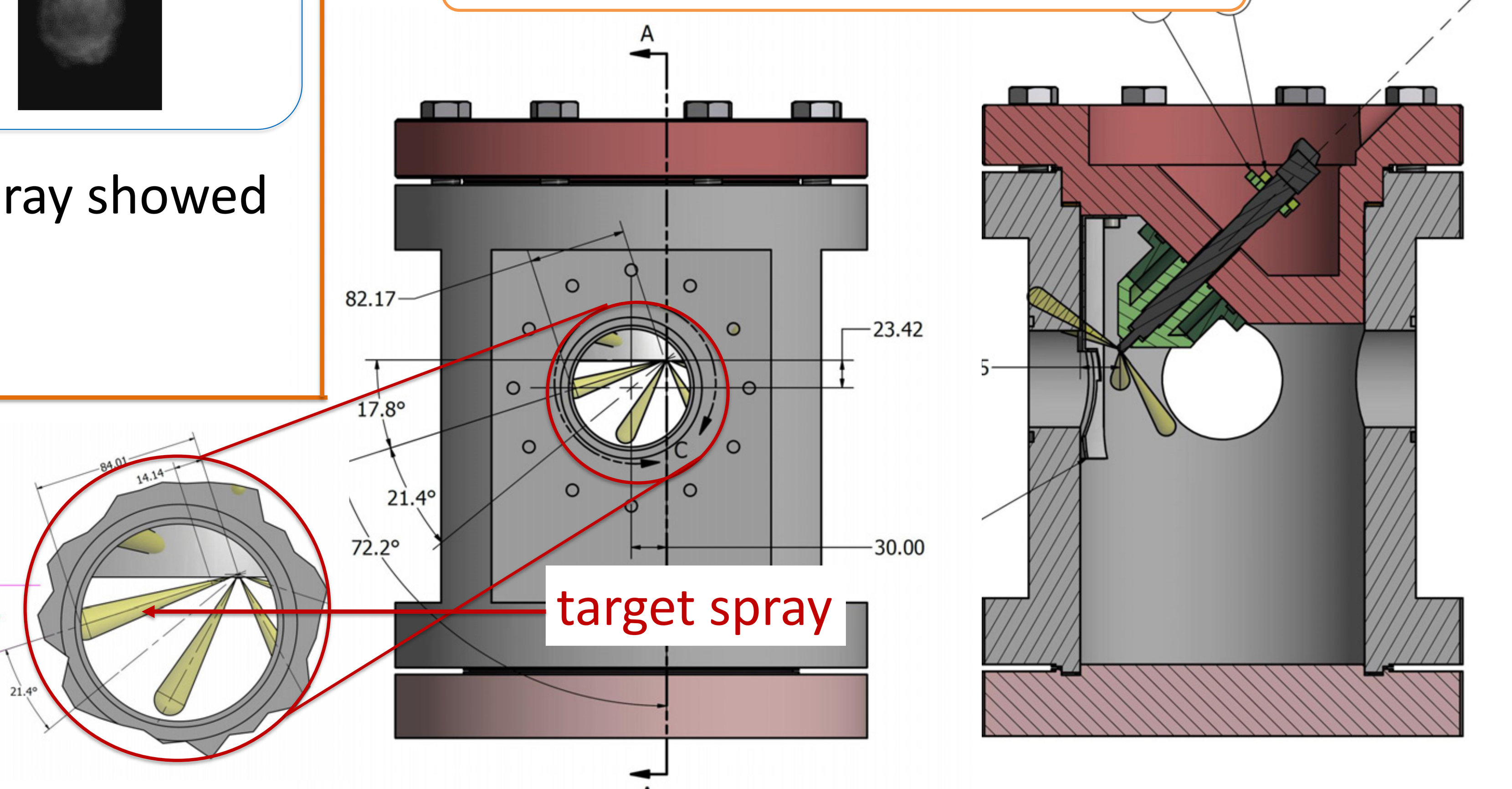
Non-evaporating conditions — Liquid phase (Mie scattering)





- Despite the identical ambient density condition, the non-evaporated spray showed higher penetration compared to that of evaporated.
  → Lost of momentum during evaporation

Multi-hole nozzle (ϕ0.123 x 7)



- The design of the multi-hole injector adaptor is in process.
  → The target spray is positioned on a vertical plane in order to derive vapor concentration with LAS technique.

Future Work

- Analysis on the mixture concentration distribution
- Supply the data of the spray and mixture distribution to the modelling group.
- Multi-hole nozzle experiment (Mass distribution of a single spray plume, comparison with single-hole nozzle)