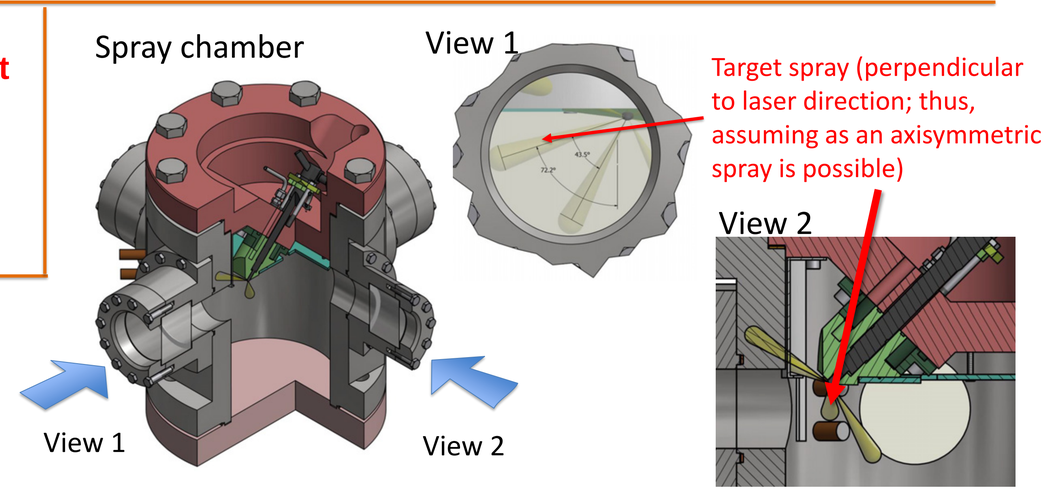
ディーゼル燃焼チーム クラスター大学(1)（グループ1）

広島大学　大学院工学研究科
西田　恵哉，尾形　陽一，KIM Jaeheun, 各務　伸一

Diesel mixture formation characteristics of a multi-hole injector
- A comparison with a single-hole injector

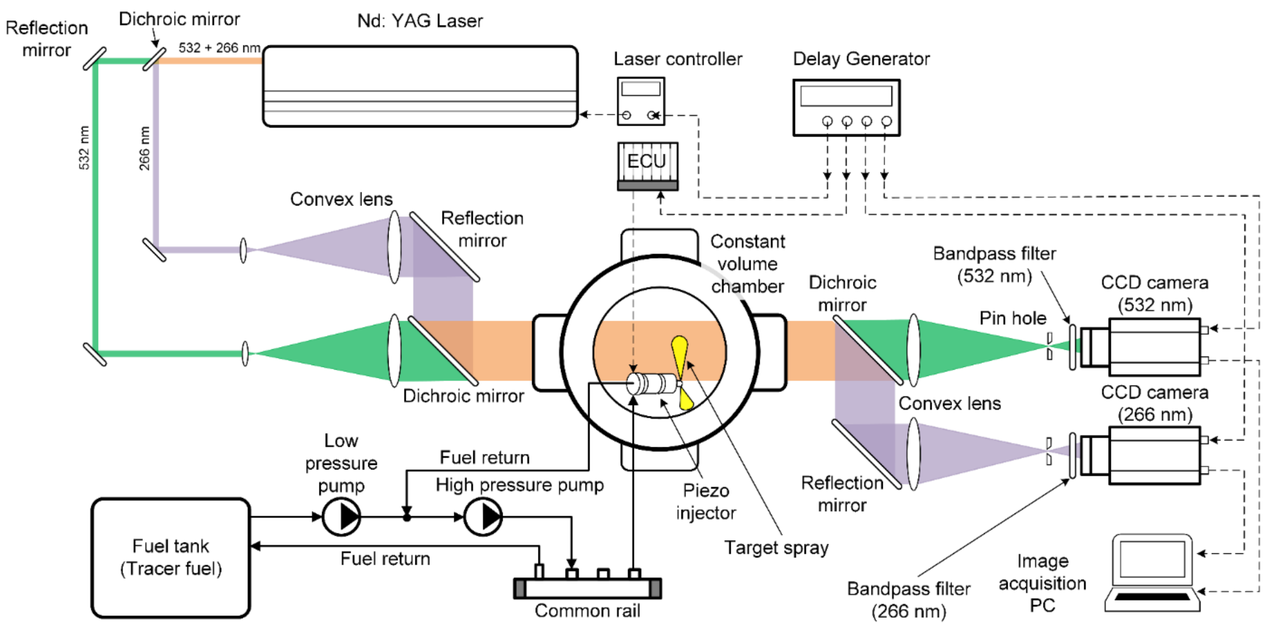
Research Objectives

- **Investigate the mixture formation characteristics of a multi-hole injector under transient (small injection quantity) and quasi-steady condition (large injection quantity)**
- **Perform a comparison between single-hole injector and reveal the dominant control parameters for the differences in spray mixture formation.**



Methodologies

Optical arrangement for LAS (Laser Absorption Scattering) techniques



✓ **Experimental conditions**

Injection quantity [mg/stroke/hole]	0.5, 2.5
Ambient density [kg/m3]	8.42
Ambient pressure [MPa]	2.00
Ambient temperature [K]	800
O2 concentration [%]	0

✓ **Injector specification**

	Single-hole	Multi-hole
Nozzle diameter	0.123	0.123
Spray included angle	-	155

➢ **Under same injection pressure ($p_{Rail,Single} = p_{Rail,Multi}$)**

Injection pressure [MPa]	100

*Energizing duration is the duration of the signal.

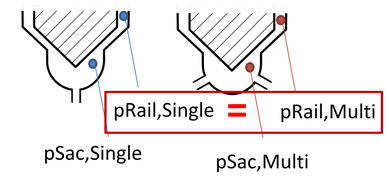
➢ **Under same injection rate profile ($p_{Sac,Single} = p_{Sac,Multi}$)**

	p_{Rail} [MPa]	*Energ. dur [μs]	Inj. mass [mg]
Single-hole	30	170	0.53
Multi-hole	100	200	0.59

Main Results

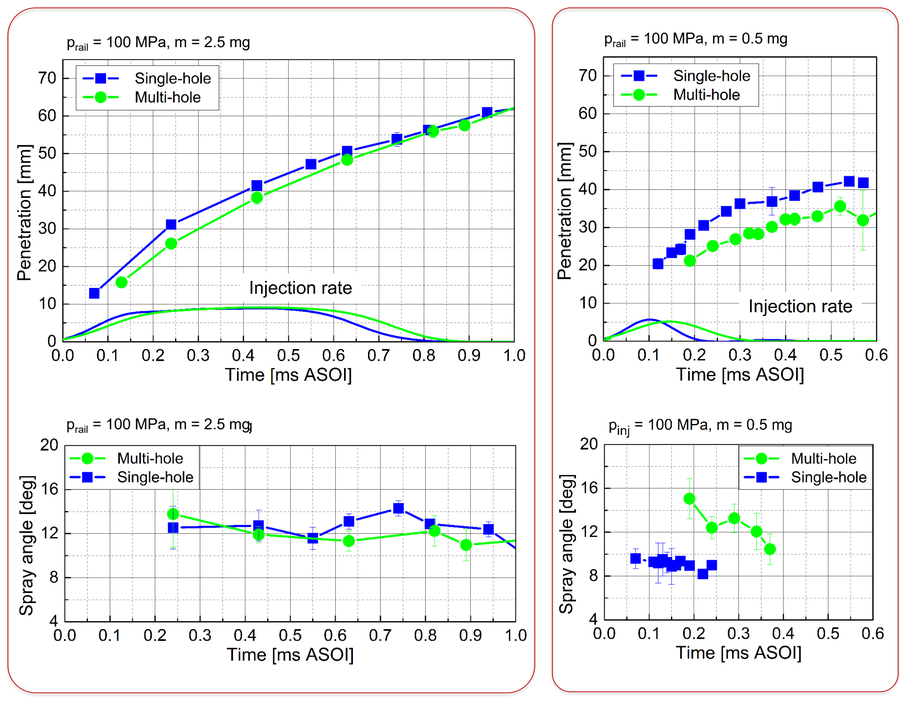
Basic spray characteristics

$p_{Rail,Single} = p_{Rail,Multi}$

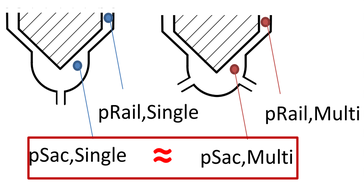


Quasi-steady spray (m_{inj} = 2.5 mg)
- Similar spray structure in terms of mixture concentration before EOI

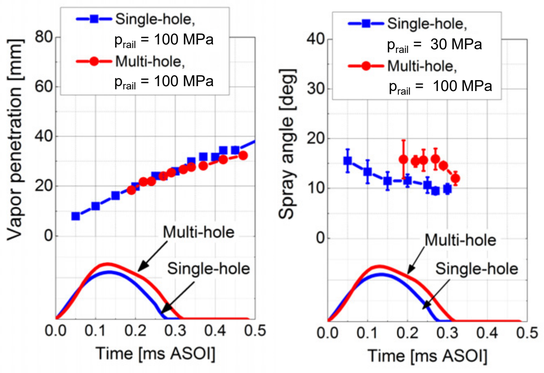
Transient spray (m_{inj} = 0.5 mg)
- Superior mixture formation for single-hole injector (Longer penetration, greater entrainment)



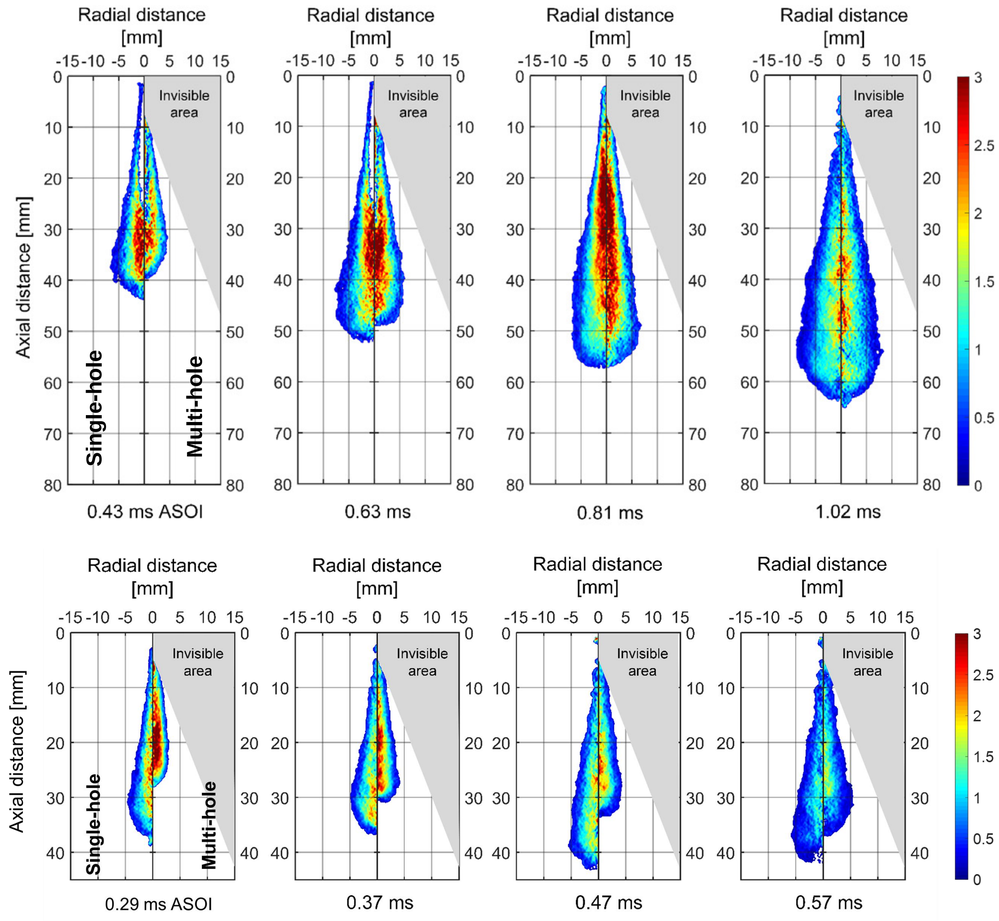
$p_{Sac,Single} = p_{Sac,Multi}$

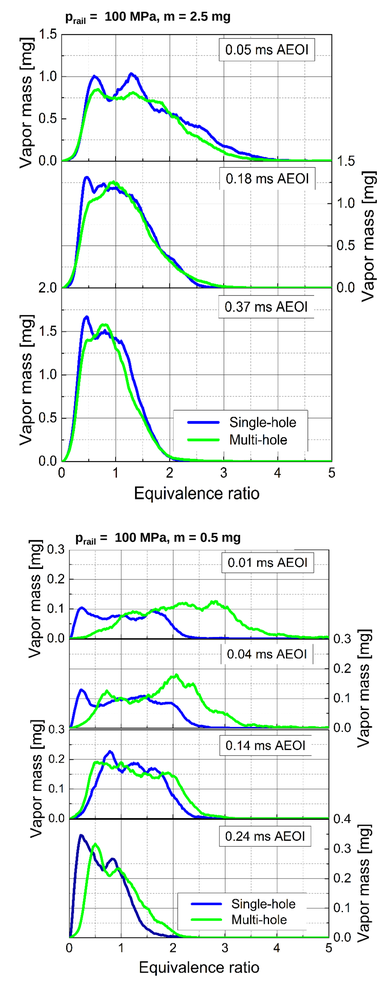


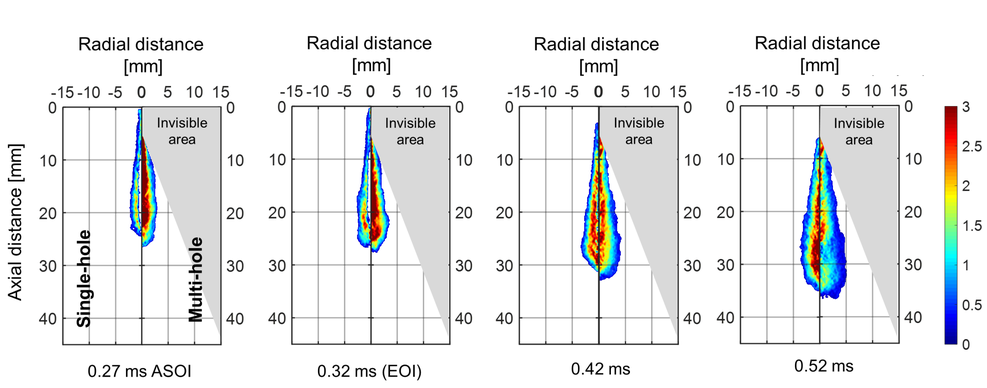
Transient spray (m_{inj} = 0.5 mg)
- Same penetration for both injectors; however, wider spray angle for multi-hole injector.
- Thus, superior mixture formation for multi-hole injector

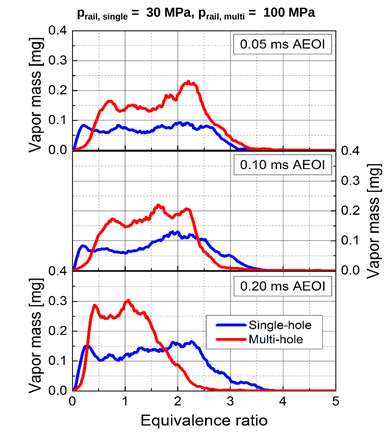


Mixture distribution









Conclusions

- Analysis on the mixture concentration distribution (equivalence ratio) from a multi-hole injector was possible by assuming as an axisymmetric spray.
- A comparison on the mixture formation was conducted between multi-hole and single-hole injectors under same injection pressure (rail pressure), or same injection rate condition.
  - ✓ The mixture formation was superior for single-hole injector under same injection pressure (rail pressure), due to the greater penetration and the enhanced air entrainment.
  - ✓ The mixture formation was superior for multi-hole injector under same injection rate condition. It was mainly due to the greater spray angle of the spray from multi-hole injector.