

In Cylinder Flow Fields in Diesel Engine

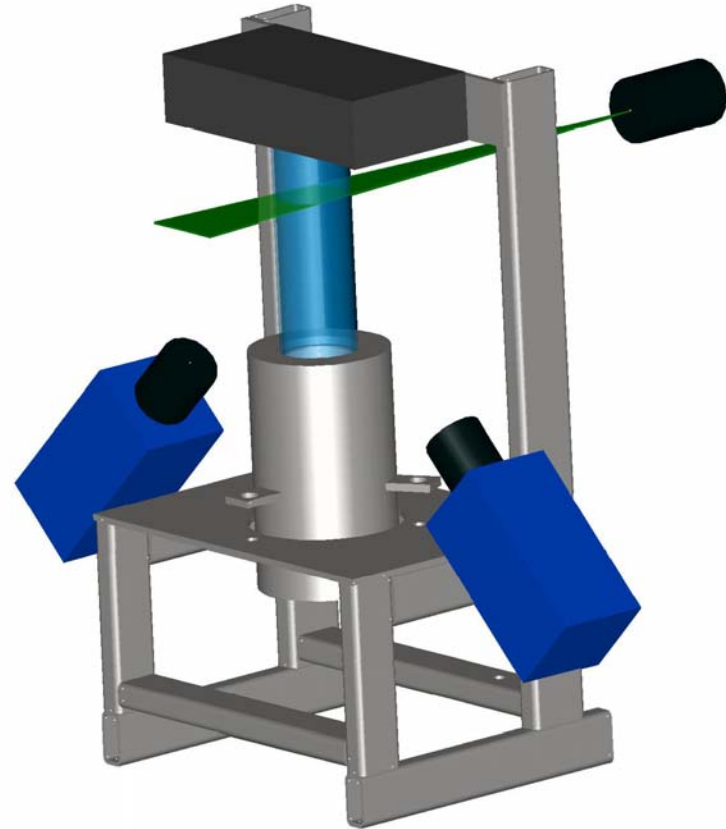
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In Cylinder Flow Fields in Diesel Engine

- **Simulations of in-cylinder flows and fuel sprays**
- **Optical measurements with lasers and double frame cameras**
- **Fuel spray measurements and flow field measurements**
 - Particle Image Velocimetry (PIV) measurements
 - Fuel spray and in-cylinder swirl (steady state)
 - Backlight imaging

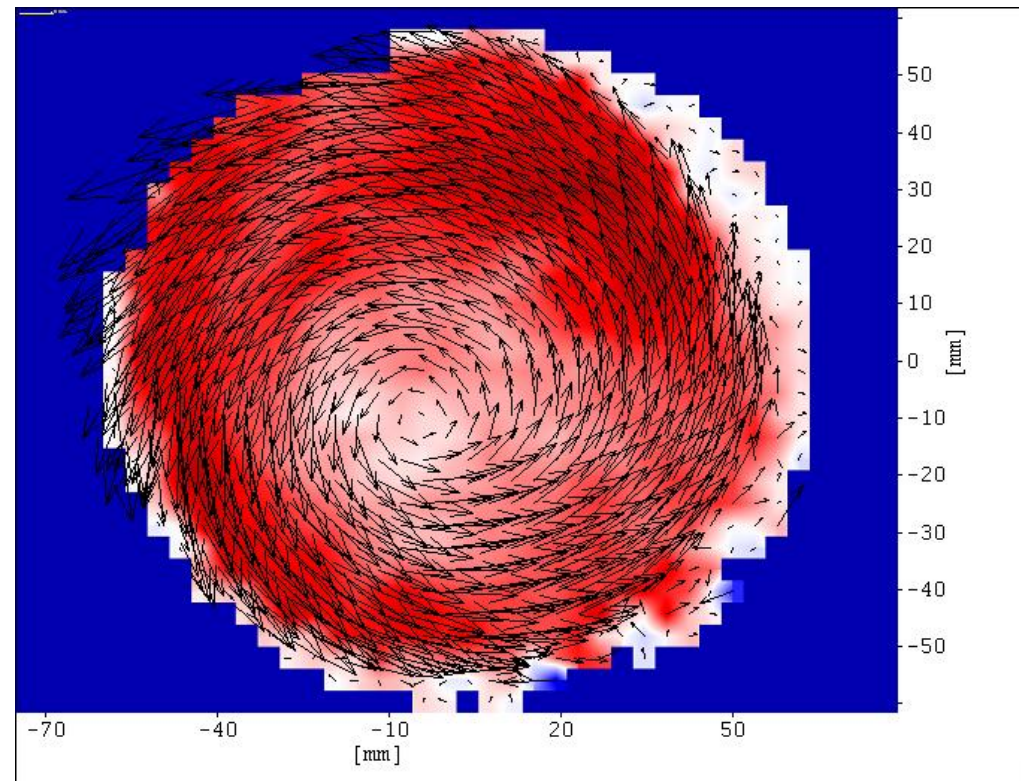
In cylinder swirl measurements at a static flow rig

- **PIV measurements**



In cylinder swirl measurements at a static flow rig

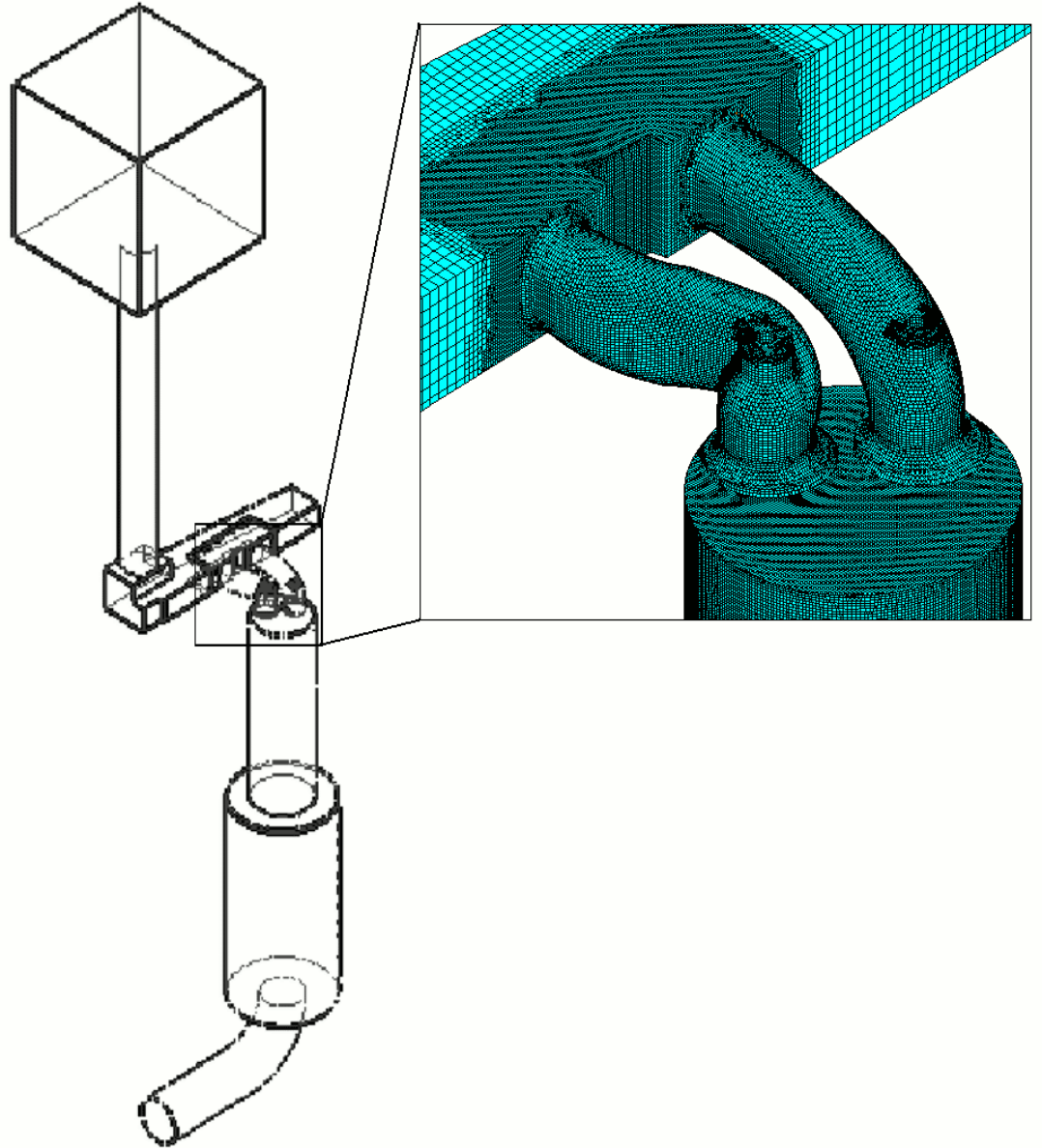
- Swirl at different distances from the cylinder head
- 3D flow field



**194mm from cylinder head,
9mm valve lift**

Computation

1.7 million cells

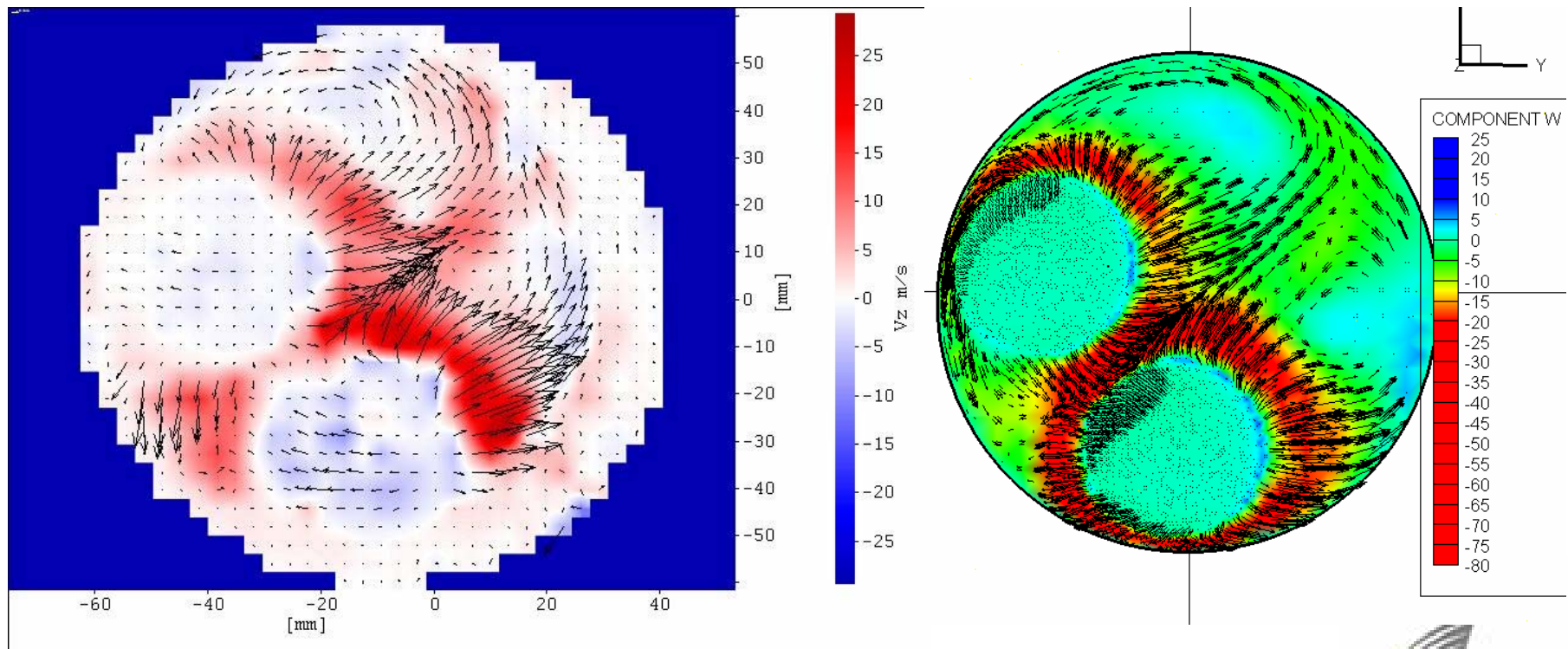


Computation

Valve lift		Pressure difference (Pa)		Mass flow rate (kg/s)	
		Measured	Sim.	Measured	Sim.
3.7mm	k-e	2500	2430	0.0367	0.0442
	RNG	2500	2456	0.0367	0.0476
7.7mm	k-e	2500	2476	0.0695	0.0673
	RNG	2500	2451	0.0695	0.0720
11mm	k-e	2500	2490	0.0755 *	0.0728 *
	RNG	2500	2535	0.0755 *	0.0720 *

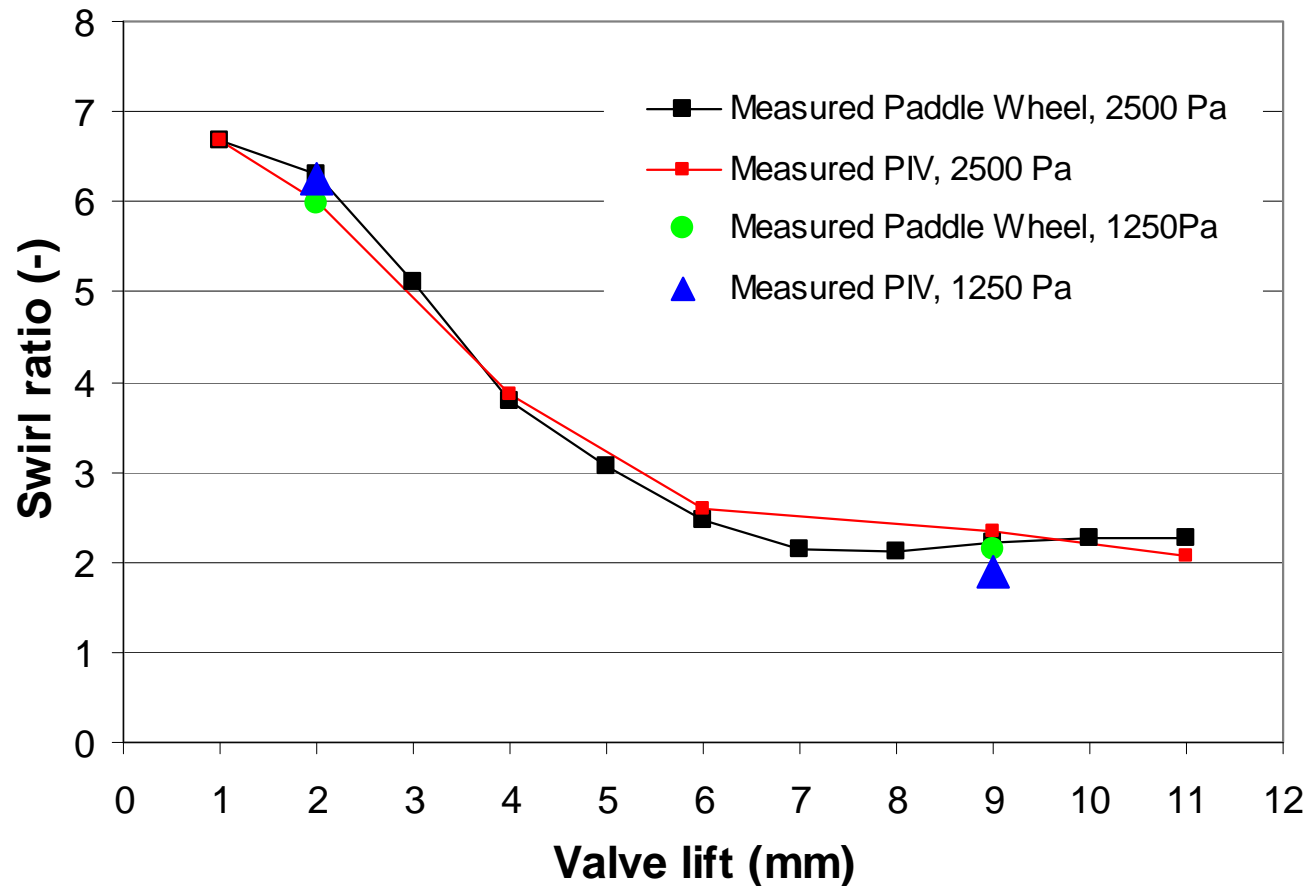
In cylinder swirl measurements at a static flow rig Compared to Computation

- Measured (left) and simulated (right hand side)
- 9mm from the cylinder head

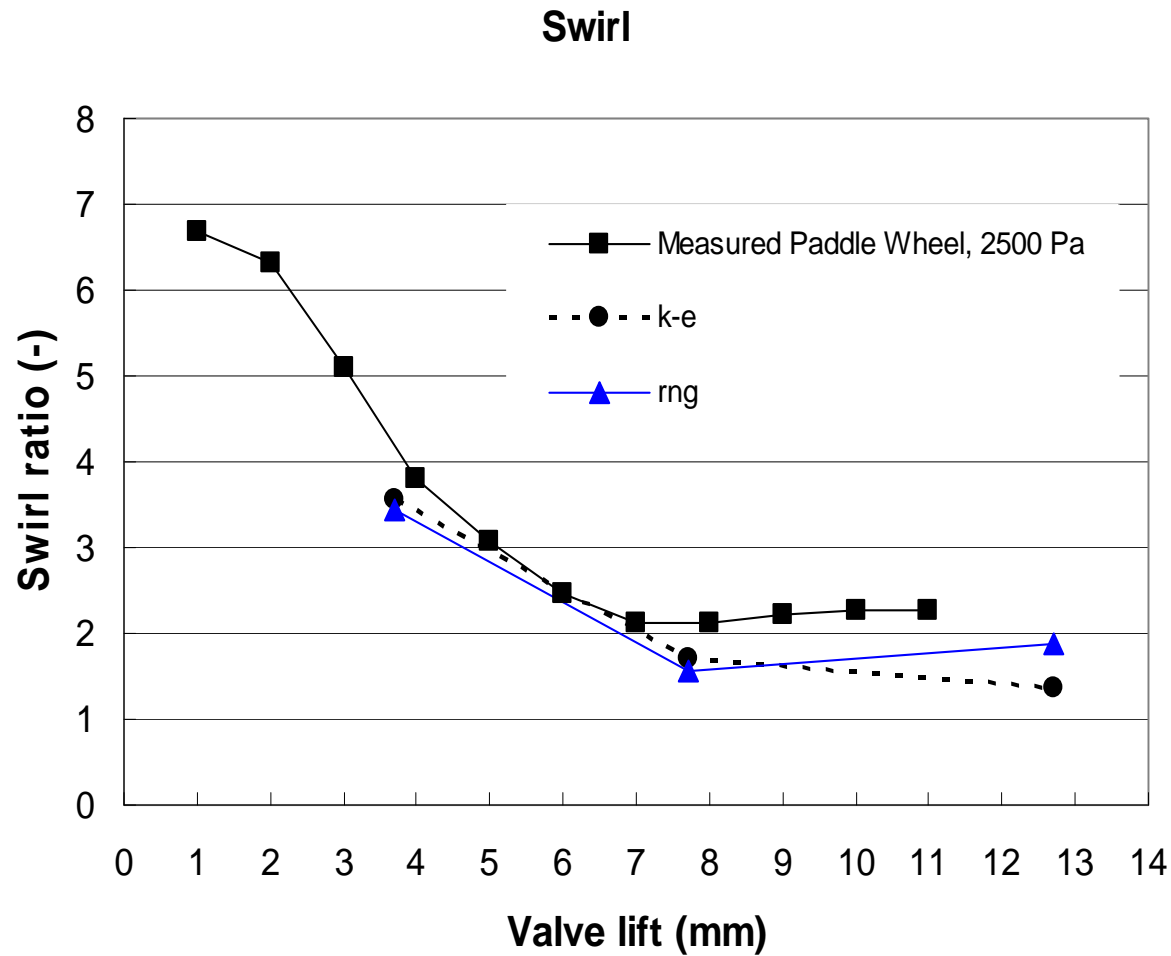


In cylinder swirl measurements at a static flow rig

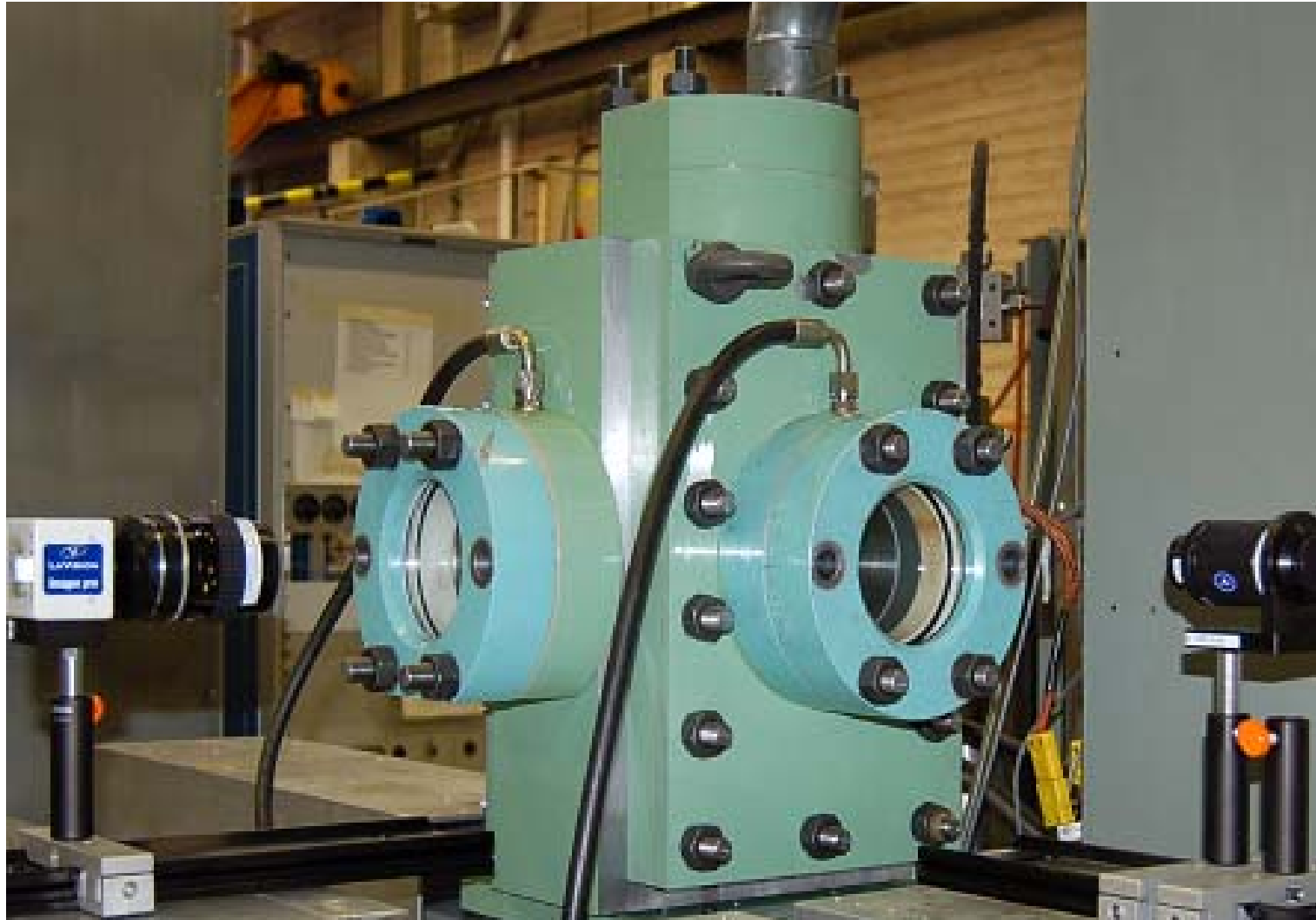
Measured Swirl



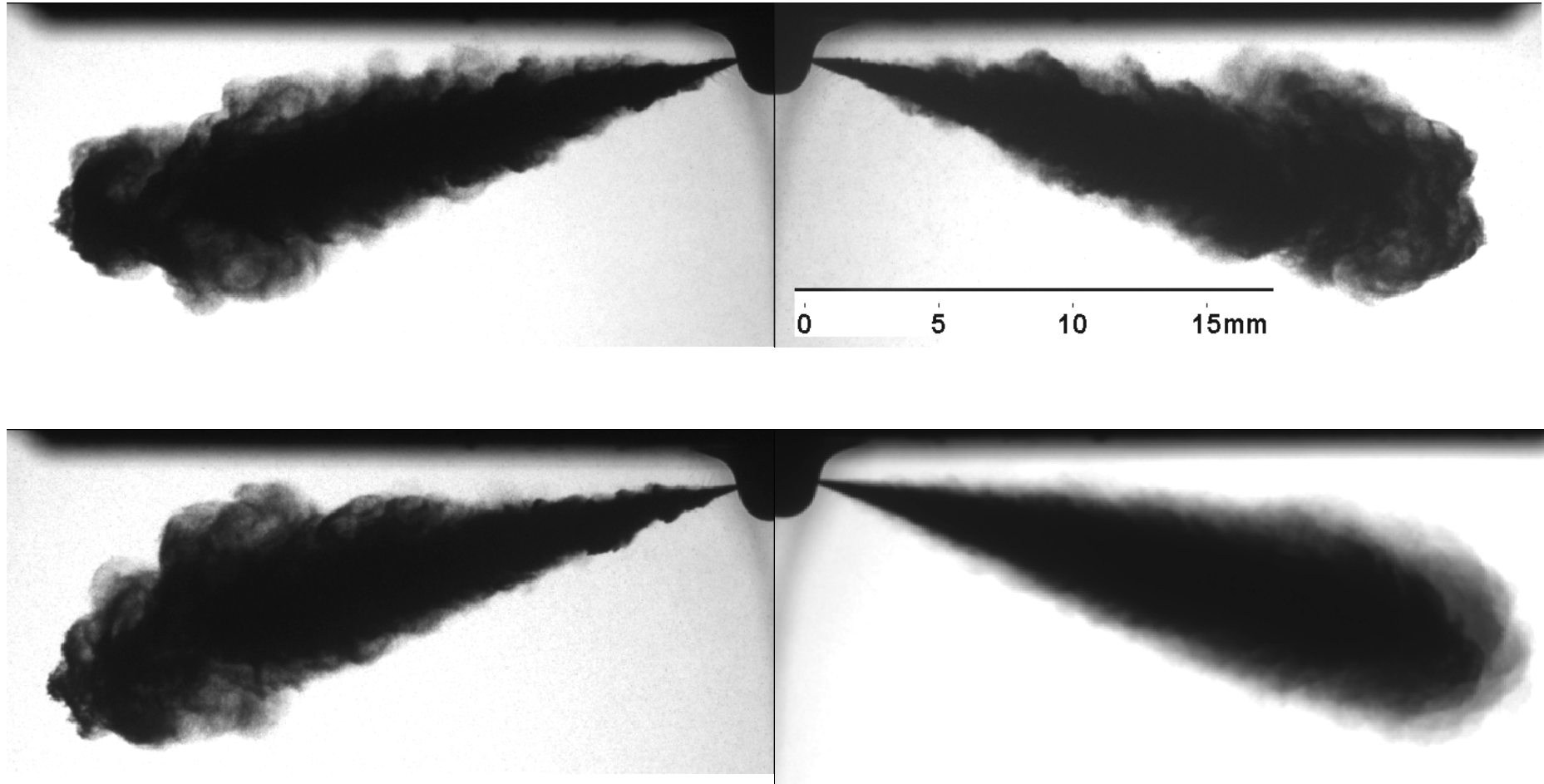
Simulations compared to measurements



Pressurized injection test rig with optical access



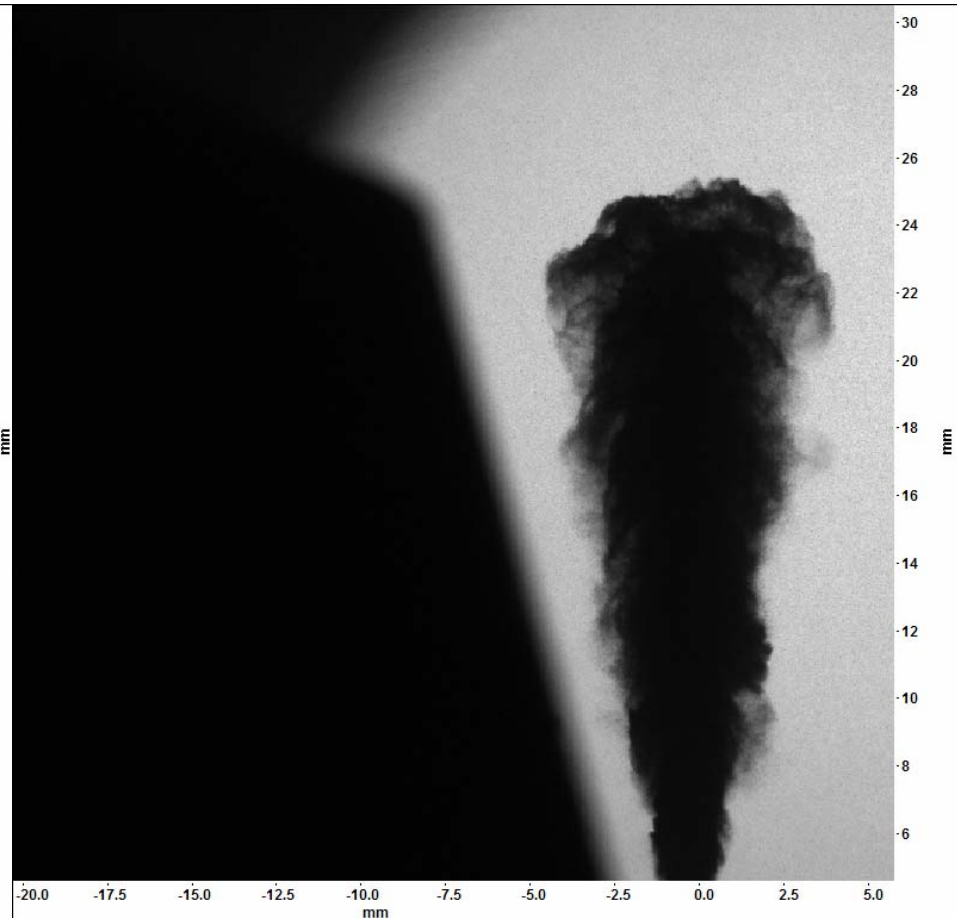
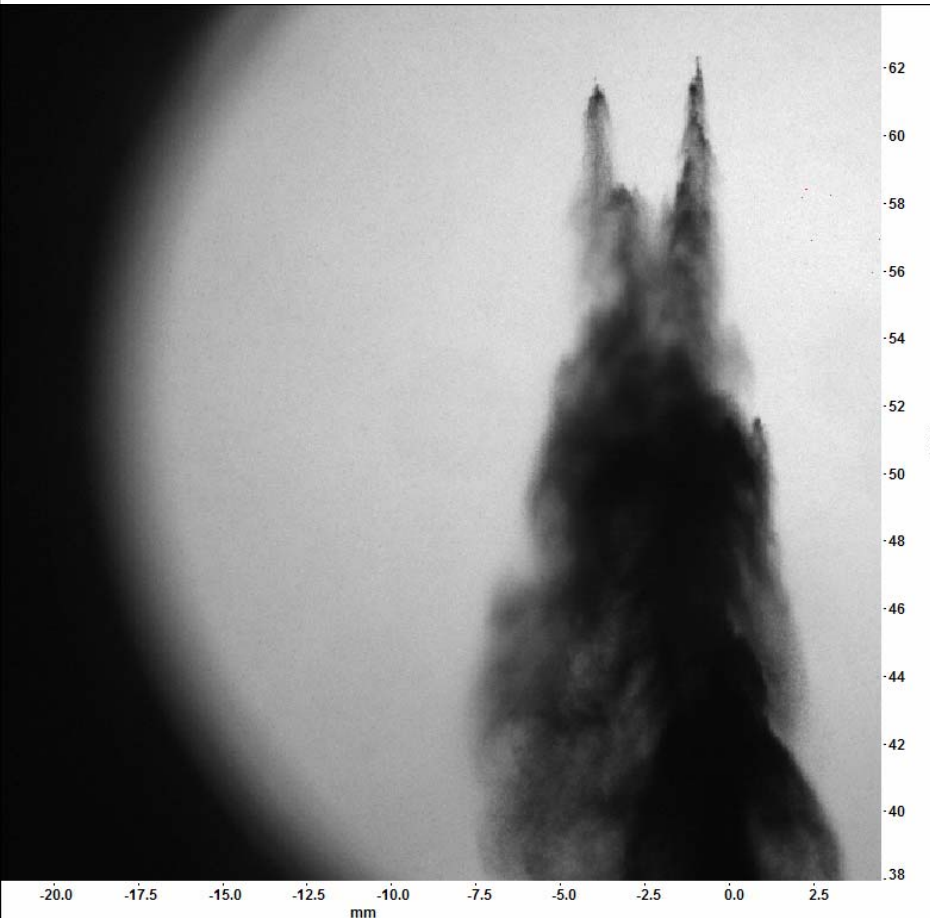
0.16mm orifice, 1300 bar injection pressure and 35kg/m³ gas density



Density of ambient gas has a major effect on the fuel spray characteristics

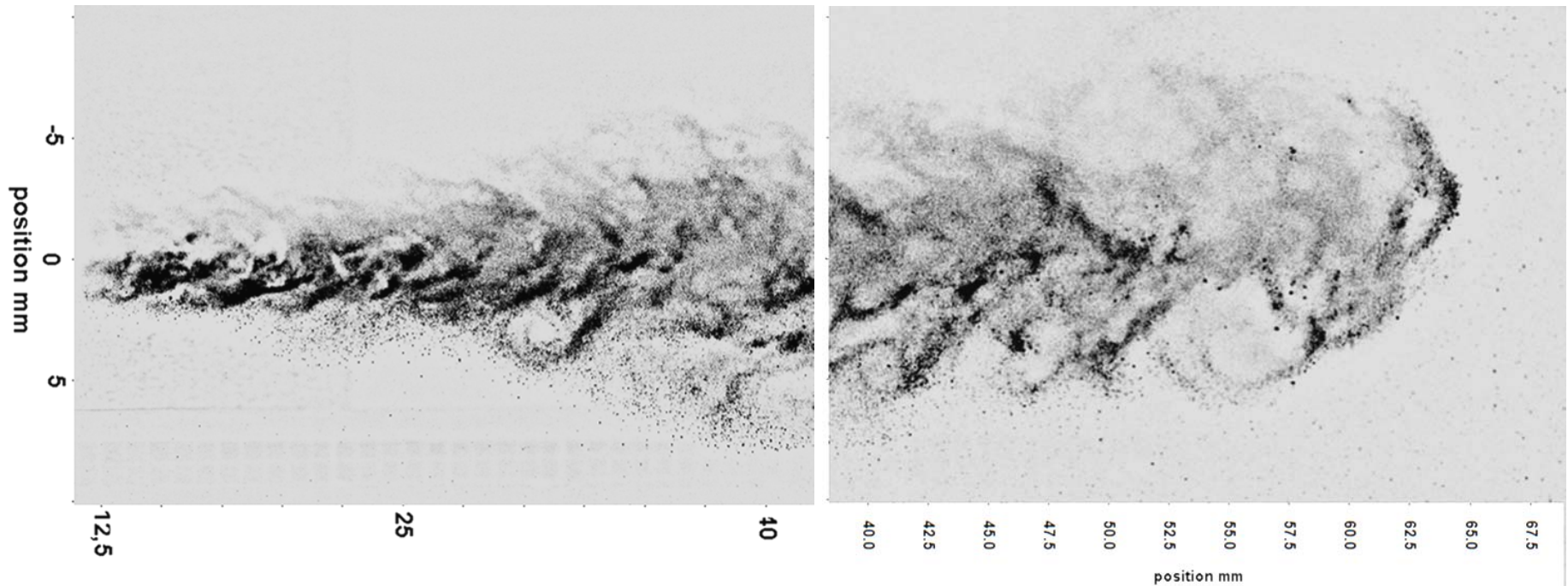
3 kg/m³

35 kg/m³

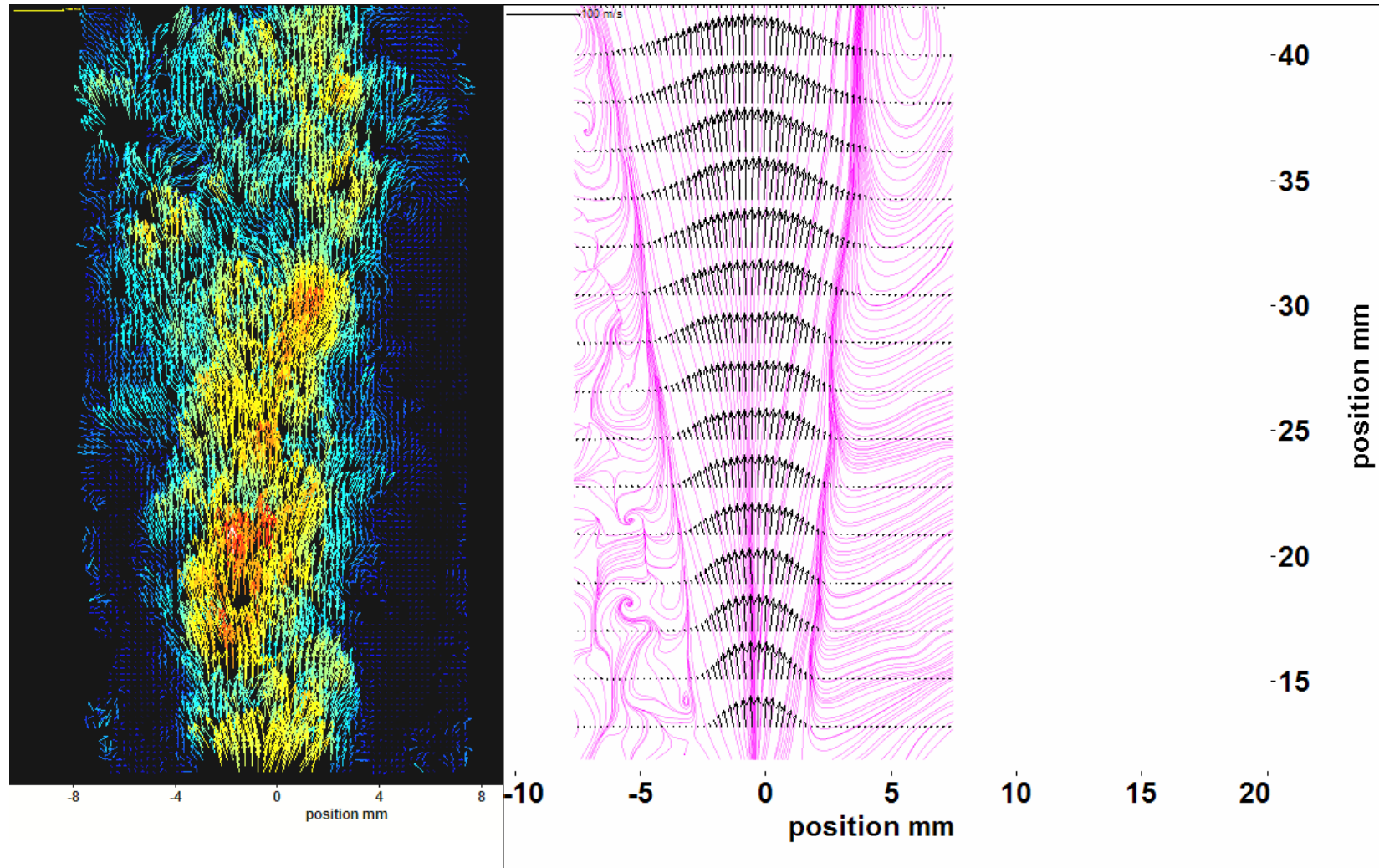


Injection pressure: 1300 bar

PIV -imaging of fuel spray (1000bar inj.p., 20kg/m³ gas density)

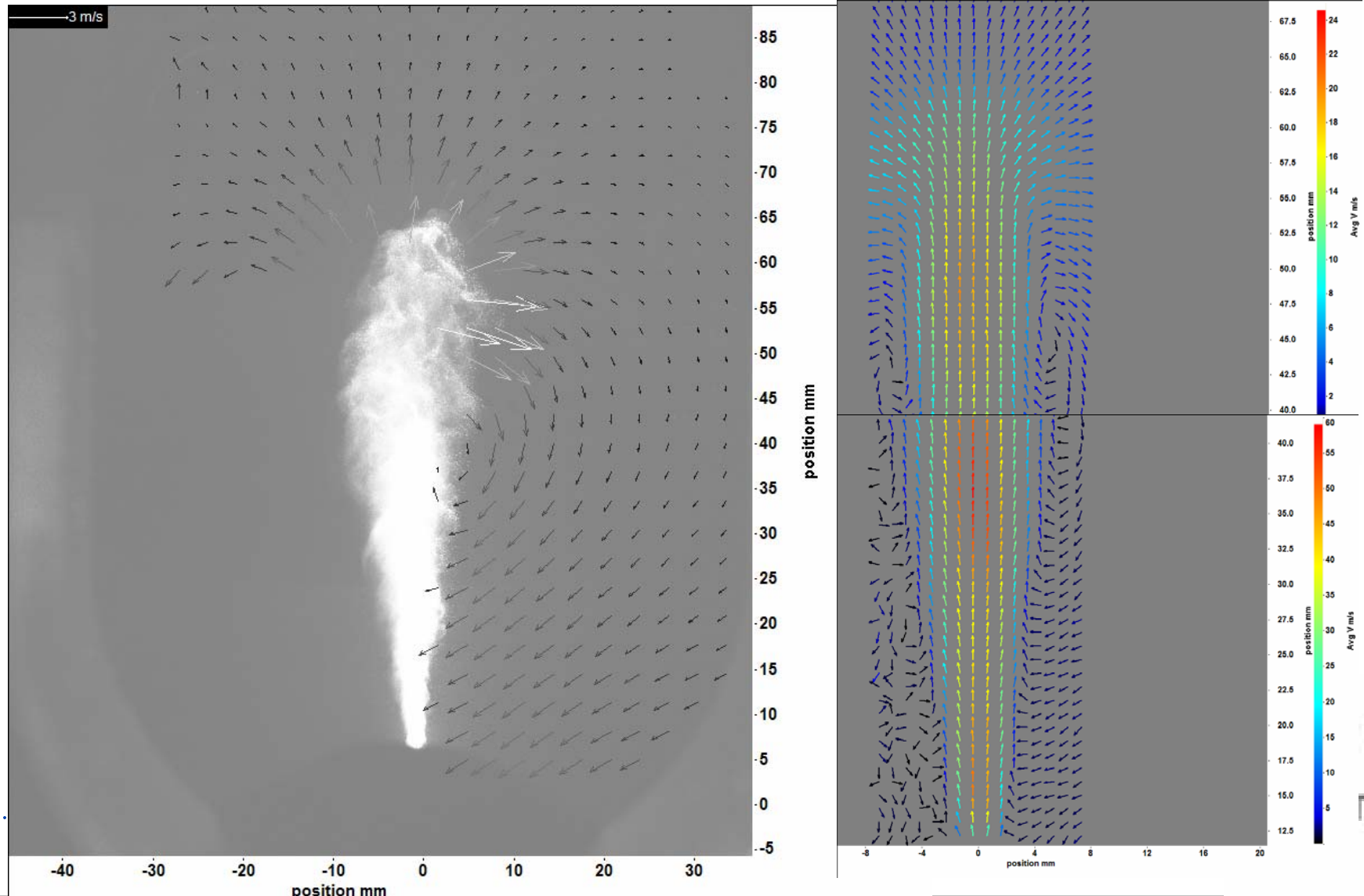


PIV flow field results of fuel spray



PIV - measurements

Left: Fuel spray generates flow field to surrounding gas (average). Right: Average flow field inside the fuel spray.



Optical access to large bore medium speed engine: Flow field measurements and fuel spray characterization

