4. PIV Measurement of Internal Structure of Diesel Fuel Spray

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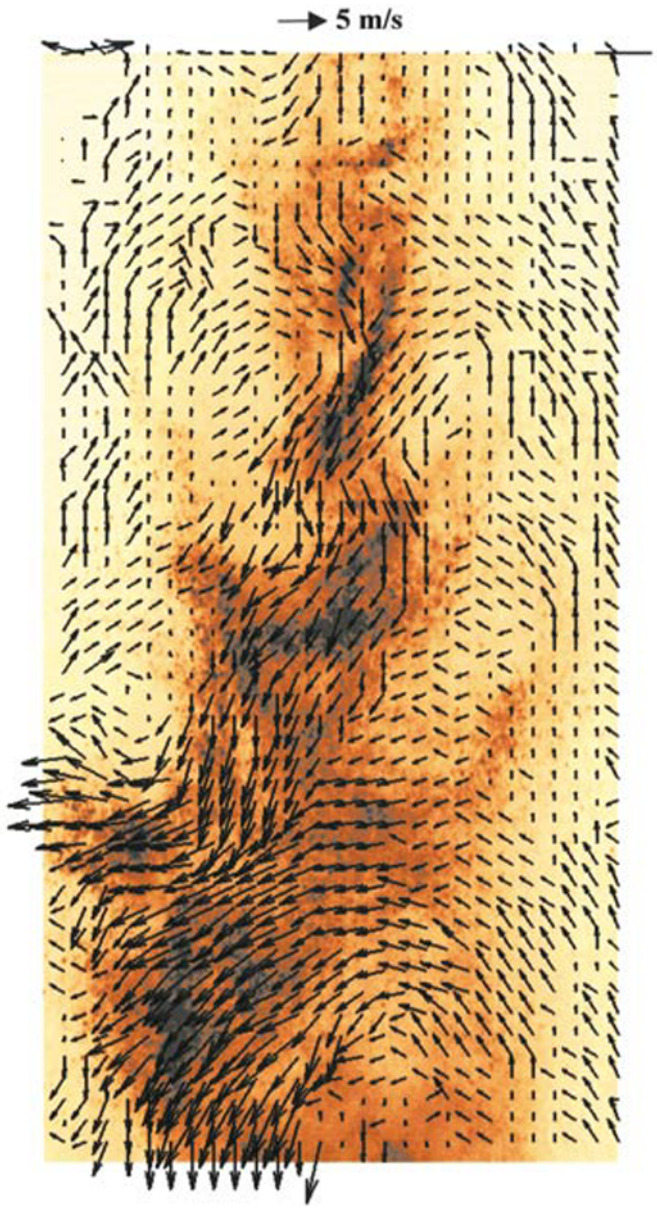
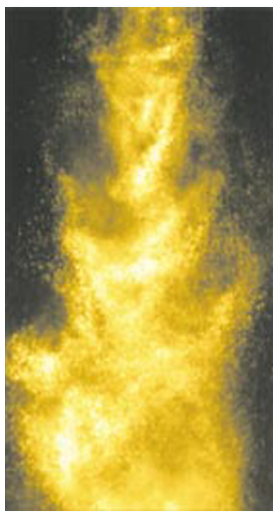
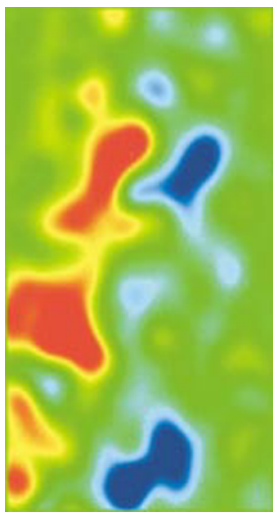


(b) PIV result and internal structures, uniform convection velocity, 2.0 m/s, subtracted from axial velocity component.



(a) LIF image of diesel fuel spray.



(c) Pseudo-vorticity distribution.

Internal structures of diesel fuel spray injected from a single hole nozzle at high injection pressure are visualized using a LIF technique with Rhodamine B ($C_{28}H_{31}ClN_2O_3$) as fluorescent dye. Double-pulsed Nd:YAG laser beams, 532 nm in wavelength and 200 mJ in pulse energy, shaped into a 0.3 mm thick sheet of light are used to excite the dye, which emits fluorescence centered on 590 nm. Large-scale internal structures, known as 'branch-like structures', of atomized fuel droplets are seen in Fig. 1(a), which is acquired at 4.0 ms after the injection made at an injection pressure of 50 MPa in N_2-gas atmosphere pressurized to 2.0 MPa. A corresponding PIV result obtained from doubly pulsed LIF spray images separated at 8 μs is shown in Fig. 1(b), which reveals the existence of active vortical motions of atomized fuel droplets. Note that uniform convection velocity, 2.0 m/s, is subtracted from the axial velocity component in this figure. As highlighted in the pseudo-vorticity distribution in Fig. 1(c), those active vortical motions are associated with the large-scale internal structures, which appear to be responsible for the mixing between fuel and surrounding gas.