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Investigation of the Mixing Process in an Axisymmetric Turbulent Jet Using PIV and LIF

by

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ABSTRACT

In the present paper, mixing of a passive scalar in a self-preserving axisymmetric turbulent jet at a Reynolds number of 2×10^3 is studied utilizing combined particle image velocimetry (PIV) and planar laser induced fluorescence (LIF). Detailed measurements are made for the mean velocity, turbulent intensity of velocity fluctuation, Reynolds shear stress, mean concentration, concentration fluctuation intensity, and turbulent flux at the center plane of the jet. In order to examine the reliability of the results, mass balances that are based on the mass-balance equation are also estimated. These results will be a reference data set for further investigation of the chemically reacting turbulent jet. The results are compared with the results from direct numerical simulation, point velocity measurements, and combined PIV, particle tracking velocimetry (PTV), or laser Doppler velocimetry (LDV) and LIF measurements. All the properties collapse onto self-similar profiles in the far field (30-60 diameter downstream from the nozzle) of the jet, and agree with the previous data. In the case of the present data, the mass balances are conserved quite well.

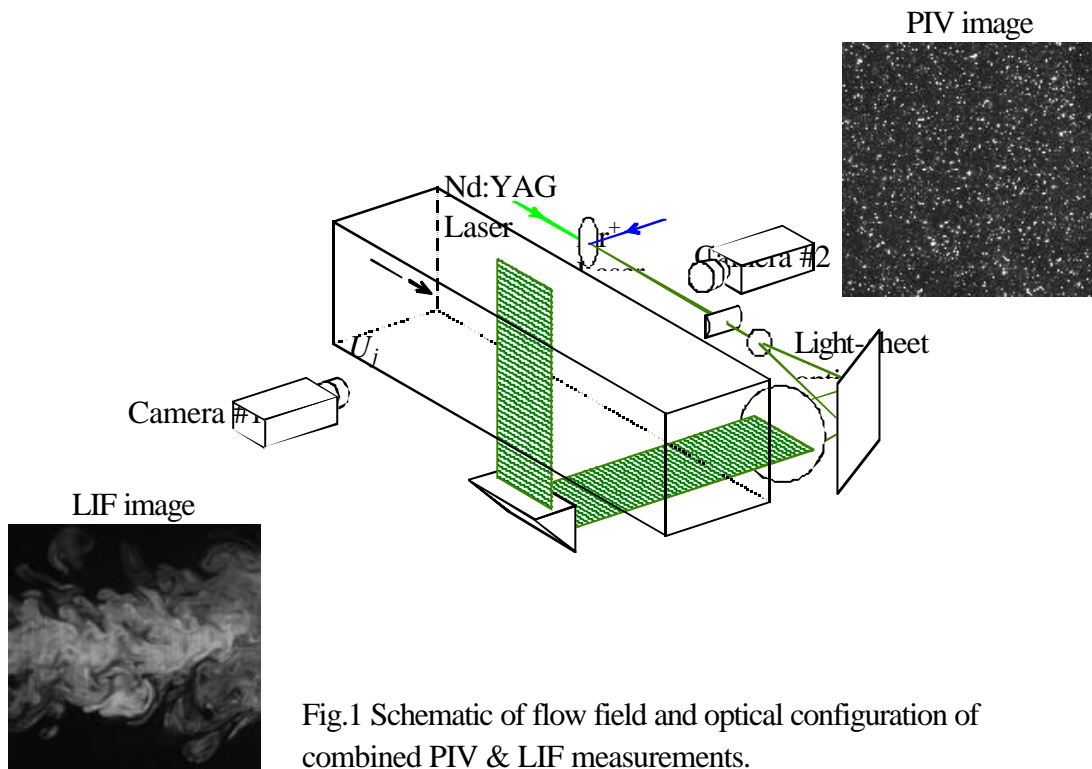


Fig.1 Schematic of flow field and optical configuration of combined PIV & LIF measurements.