LIF measurements of concentration in a coaxial jet mixer

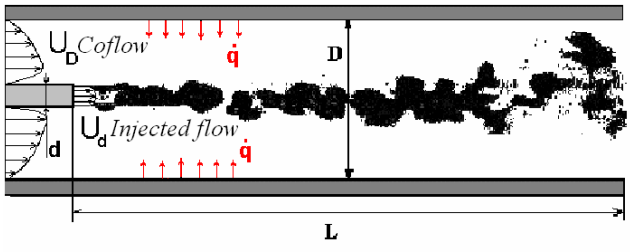

Fig. 1: Schematic view of the object of investigation

LIF measurements: repetition rate 10 Hz, spatial resolution 0.05m/162 (about 300µ)

1) Geometrical properties and parameters of the coaxial jet mixer

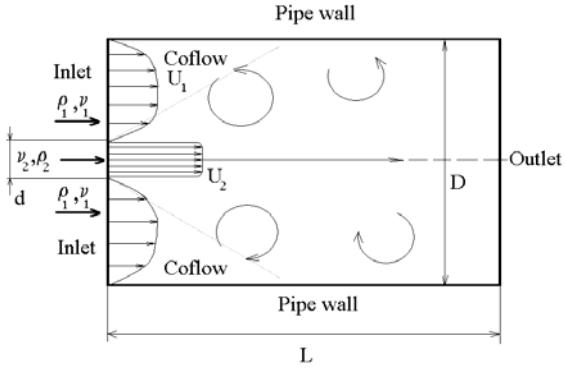

Fig. 2: Schematic view of 2d section of pipe

quantity	unit	value
inner diameter of the nozzle	d/mm	10
inner diameter of pipe	D/mm	50
Length of the pipe	L/mm	400

2) Experimental Boundary conditions for the R-Mode case (recirculation zone) with water:

Quantity	Symbol/Unit	Value
Properties based on nozzle		
Flow rate	Q_d/(l/h)	337
Temperature of the fluid	T_d/(°C)	13,2
Kinematic viscosity	ν/(m²/s)	1,193E-6
Bulk velocity	U_d/(m/s)	1,192
Reynolds number	Re_d	9989
Properties based on Coflow		
Flow rate	Q_C/(l/h)	430
Temperature of the fluid	T_C/(°C)	13,8
Kinematic viscosity	ν/(m²/s)	1,175E-6
Bulk velocity	U_C/(m/s)	0,0634
Reynolds number	Re_C	2588,37

3) Experimental Boundary conditions for the J-Mode case with water:

Quantity	Symbol/Unit	Value
Properties based on nozzle		
Flow rate	Q_d/(l/h)	322
Temperature of the fluid	T_d/(°C)	15
Kinematic viscosity	ν/(m²/s)	(see in handbooks)
Bulk velocity	U_d/(m/s)	1,14
Reynolds number	Re_d	10000
Properties based on Coflow		
Flow rate	Q_C/(l/h)	1607
Temperature of the fluid	T_C/(°C)	15
Kinematic viscosity	ν/(m²/s)	See in handbooks
Bulk velocity	U_C/(m/s)	0,228
Reynolds number	Re_C	

4) Content of files with experimental data:

4.1) Files xD*.*.dat

. denotes a distance measured from the first measurement section (x/D=0) and referred to the pipe diameter D=50 mm.
The first measurement section was located at the distance 5 mm downstream of the nozzle. For instance, x/D=1.5 means the test section located at 1.5*0.05+0.005=0.08 m from the nozzle.

Number of point	R/D	R, m	Mixture fraction *f*	RMS of the Mixture Fraction $\overline{f'^2}$	Mixture fraction smoothed	RMS of the light intensity	RMS of noise for the mixture fraction	Coefficient of calibration used to calculate the noise	*f/f_max*	$\overline{f'^2}$ */f_max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

Here R is the vertical coordinate from the lower wall to the upper wall of the enclosing pipe, $f\_\max$ is the maximum mixture fraction in the section. The results presented here were not smoothed. That is why the columns (4) and (6) are identical.

For comparisons please use the columns 2, 4, 5, 10 and 11. The columns 7-9 contain auxiliary data necessary only for our internal purposes.

4.2) Files xD*.*les.dat

Number of point	R/D	R, m	Filtered Mixture fraction g	RMS of the filtered Mixture Fraction $\overline{g'^2}$	$\overline{g'^2}$ */f_max*
(1)	(2)	(3)	(4)	(5)	(6)

These data were calculated for LES validations. We used a simple rule for the filtration in the vertical direction:

$$g_i = \frac{1}{5}(f_{i-2} + f_{i-1} + f_i + f_{i+1} + f_{i+2});\ \text{i=12,170}$$

Due to lack of data the filtration has been done only in the vertical direction. For this case 5 points in the LIF measurements correspond to one cell in LES calculations with 32 control volumes across the pipe.