

1 Supplemental data

Table S1 presents the experimental Reynolds numbers, the corresponding flow rates and the free-stream velocities obtained.

Table S1 Test values of flow rate and free-stream reference velocity (U_e) at a range of Reynolds numbers

Reynolds number (Re)	Flow rate (litres s^{-1})	U_e ($m s^{-1}$)
3738	≈ 5	0.0935
5452	≈ 7	0.1363
7908	≈ 11	0.1977
17388	≈ 23	0.4347

Table S2 presents the selected horizontal positions.

Table S2 Positions in x direction

Distance from inlet (cm)	x position (cm)	Distance (x/h)
428.0	-12.5	-3.12
444.5	4.0	1.0
446.5	6.0	1.5
448.5	8.0	2.0
452.5	12.0	3.0
456.5	16.0	4.0
464.5	24.0	6.0
480.5	40.0	10.0
516.5	76.0	19.0

Figure S1 depicts the stream-wise power spectrum obtained for the raw data, for $x/h = 19$. Using the raw data, the effect of the high noise levels is evident.

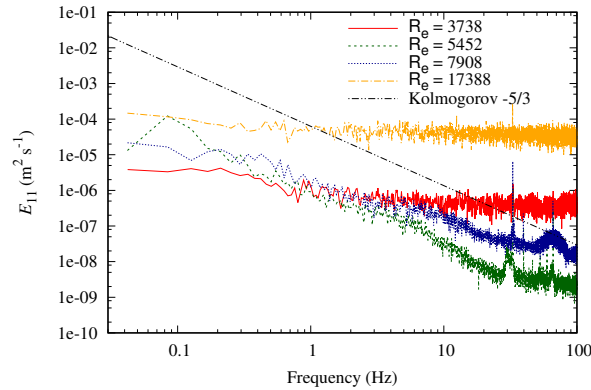


Figure S1 Power spectral density of flow in the stream-wise direction, for raw data and position $x/h = 19$

The measured mean velocities and corresponding uncertainty, normalized mean stream-wise velocities, and normalized Reynolds shear stresses and normal Reynolds stresses for $Re = 7908$, after post-processing, are presented in Tables S3 to S11.

Figure S2 shows an example of a time series used to calculate the velocities (for $Re = 7908$ at $x/h = 19$ and $y/h = 1$) with 47497 particles, which is long enough to assure that the data are stationary.

Figure S3 presents the mean stream-wise velocity profiles (zoomed) for various Re at horizontal position $x/h = -3.12$.

Table S3 Measurements for $R_e = 7908$ at $x/h = -3.12$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$< -u'v' >/U_e^2$ (-)	$< u'u' >/U_e^2$ (-)	$< v'v' >/U_e^2$ (-)
1.025	0.0206	± 3.8	-0.0008	± 5.6	0.1044	-0.0000	0.0049	0.0001
1.050	0.0606	± 3.3	0.0005	± 14.5	0.3065	0.0000	0.0173	0.0002
1.075	0.0704	± 3.4	0.0008	± 13.6	0.3562	0.0002	0.0181	0.0004
1.100	0.1142	± 2.2	0.0004	± 91.2	0.5777	0.0002	0.0214	0.0170
1.200	0.1679	± 1.4	0.0000	± 870.1	0.8490	0.0009	0.0128	0.0010
2.000	0.1955	± 0.9	-0.0010	± 53.8	0.9888	0.0006	0.0064	0.0013
3.000	0.1976	± 0.6	-0.0013	± 73.6	0.9996	0.0003	0.0052	0.0023

Table S4 Measurements for $R_e = 7908$ at $x/h = 1$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$< -u'v' >/U_e^2$ (-)	$< u'u' >/U_e^2$ (-)	$< v'v' >/U_e^2$ (-)
0.025	0.0003	± 33.0	-0.0006	± 2.2	0.0013	-0.0000	0.0003	0.0000
0.050	0.0000	± 759.4	-0.0007	± 5.0	0.0002	-0.0000	0.0006	0.0000
0.075	-0.0021	± 43.0	-0.0004	± 32.8	-0.0108	-0.0001	0.0024	0.0003
0.100	-0.0023	± 43.3	-0.0008	± 34.3	-0.0114	-0.0001	0.0022	0.0028
0.200	-0.0098	± 27.6	0.0020	± 27.5	-0.0496	0.0002	0.0145	0.0033
0.400	-0.0119	± 26.4	0.0077	± 11.9	-0.0602	0.0004	0.0192	0.0021
0.600	-0.0136	± 21.4	0.0155	± 8.3	-0.0688	-0.0008	0.0254	0.0179
0.800	0.0038	± 50.5	0.0069	± 14.1	0.0194	0.0018	0.0383	0.0104
1.000	0.1028	± 2.7	-0.0067	± 12.8	0.5198	0.0113	0.0705	0.0139
2.000	0.2013	± 0.8	-0.0059	± 11.3	1.0180	0.0009	0.0073	0.0017
3.000	0.2020	± 0.5	-0.0058	± 10.9	1.0219	0.0002	0.0057	0.0017

Table S5 Measurements for $R_e = 7908$ at $x/h = 1.5$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$< -u'v' >/U_e^2$ (-)	$< u'u' >/U_e^2$ (-)	$< v'v' >/U_e^2$ (-)
0.025	-0.0013	± 8.0	-0.0005	± 2.0	-0.0063	-0.0000	0.0003	0.0000
0.100	-0.0092	± 17.6	0.0006	± 55.5	-0.0465	0.0000	0.0048	0.0065
0.200	-0.0208	± 13.2	0.0049	± 11.5	-0.1053	0.0006	0.0173	0.0017
0.400	-0.0186	± 13.2	0.0096	± 8.5	-0.0943	0.0001	0.0153	0.0033
0.600	-0.0089	± 28.4	0.0068	± 16.9	-0.0449	0.0012	0.0293	0.0100
0.800	0.0277	± 11.7	0.0009	± 132.4	0.1402	0.0062	0.0506	0.0109
1.000	0.1072	± 2.4	-0.0103	± 7.3	0.5420	0.0087	0.0554	0.0120
2.000	0.1920	± 0.5	-0.0087	± 6.6	0.9714	-0.0000	0.0049	0.0015
3.000	0.2043	± 0.5	-0.0073	± 12.4	1.0335	-0.0002	0.0181	0.0034

Table S6 Measurements for $R_e = 7908$ at $x/h = 2$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$< -u'v' >/U_e^2$ (-)	$< u'u' >/U_e^2$ (-)	$< v'v' >/U_e^2$ (-)
0.025	-0.0016	± 15.8	-0.0007	± 4.3	-0.0083	-0.0001	0.0008	0.0000
0.100	-0.0196	± 7.6	0.0006	± 82	-0.0989	0.0001	0.0082	0.0037
0.200	-0.0327	± 8.5	0.0045	± 16.9	-0.1656	0.0004	0.0189	0.0022
0.400	-0.0173	± 17.9	0.0043	± 39.3	-0.0873	0.0026	0.0293	0.0067
0.600	0.0109	± 29.5	0.0022	± 66.0	0.0554	0.0042	0.0385	0.0414
0.800	0.0506	± 6.0	-0.0057	± 23.5	0.2560	0.0085	0.0618	0.0157
1.000	0.1187	± 1.8	-0.0130	± 6.6	0.6005	0.0097	0.0603	0.0148
2.000	0.1975	± 0.9	-0.0102	± 5.3	0.9989	0.0008	0.0073	0.0016
3.000	0.1999	± 0.5	-0.0106	± 5.7	1.0111	-0.0014	0.0316	0.0030

Table S7 Measurements for $R_e = 7908$ at $x/h = 3$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$\langle -u'v' \rangle / U_e^2$ (-)	$\langle u'u' \rangle / U_e^2$ (-)	$\langle v'v' \rangle / U_e^2$ (-)
0.025	-0.0026	± 9.8	-0.0007	± 9.2	-0.0131	-0.0001	0.0011	0.0000
0.100	-0.0212	± 7.6	-0.0012	± 67.1	-0.1072	0.0000	0.0134	0.0051
0.200	-0.0287	± 9.9	-0.0037	± 46.7	-0.1452	0.0035	0.0326	0.0067
0.400	-0.0025	± 177.3	-0.0047	± 52.8	-0.0126	0.0084	0.0460	0.0120
0.600	0.0315	± 11.8	-0.0108	± 16.1	0.1593	0.0082	0.0529	0.0146
0.800	0.0785	± 3.3	-0.0133	± 9.3	0.3971	0.0090	0.0513	0.0130
1.000	0.1277	± 2.2	-0.0165	± 6.4	0.6461	0.0085	0.0410	0.0115
2.000	0.1825	± 0.6	-0.0144	± 4.3	0.9231	0.0001	0.0046	0.0014
3.000	0.1783	± 0.5	-0.0113	± 7.4	0.9017	-0.0005	0.0184	0.0034

Table S8 Measurements for $R_e = 7908$ at $x/h = 4$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$\langle -u'v' \rangle / U_e^2$ (-)	$\langle u'u' \rangle / U_e^2$ (-)	$\langle v'v' \rangle / U_e^2$ (-)
0.025	-0.0013	± 56.4	-0.0007	± 16.3	-0.0065	0.0002	0.0033	0.0001
0.100	-0.0094	± 21.5	-0.0207	± 8.0	-0.0478	0.0019	0.0176	0.0650
0.200	-0.0038	± 72.9	-0.0045	± 38.5	-0.0191	0.0040	0.0355	0.0090
0.400	0.0176	± 18.2	-0.0107	± 15.0	0.0888	0.0073	0.0451	0.0116
0.600	0.0492	± 6.8	-0.0125	± 14.2	0.2487	0.0125	0.0543	0.0178
0.800	0.0974	± 3.5	-0.0184	± 8.8	0.4928	0.0130	0.0572	0.0165
1.000	0.1409	± 2.1	-0.0203	± 6.5	0.7128	0.0092	0.0408	0.0125
2.000	0.1916	± 0.8	-0.0152	± 3.5	0.9691	0.0006	0.0066	0.0016
3.000	0.1981	± 0.4	-0.0112	± 5.4	1.0022	-0.0000	0.0219	0.0040

Table S9 Measurements for $R_e = 7908$ at $x/h = 6$

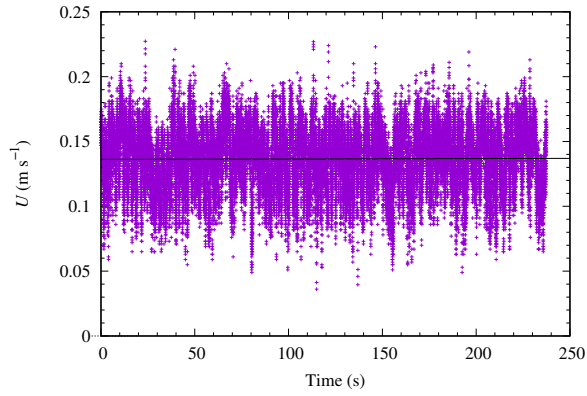
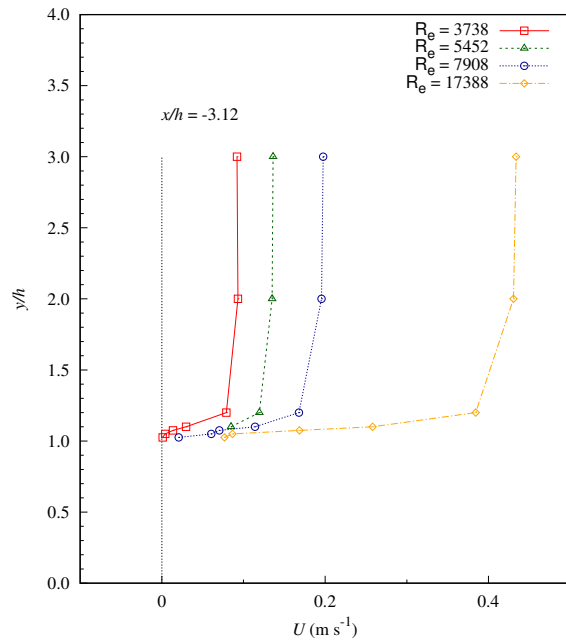
y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$\langle -u'v' \rangle / U_e^2$ (-)	$\langle u'u' \rangle / U_e^2$ (-)	$\langle v'v' \rangle / U_e^2$ (-)
0.025	0.0032	± 10.7	-0.0007	± 7.7	0.0160	0.0001	0.0013	0.0000
0.100	0.0278	± 7.2	-0.0020	± 32.1	0.1408	0.0006	0.0207	0.0028
0.200	0.0485	± 7.2	-0.0041	± 38.2	0.2452	0.0048	0.0431	0.0099
0.400	0.0665	± 5.2	-0.0095	± 17.7	0.3362	0.0091	0.0479	0.0145
0.600	0.0863	± 3.5	-0.0102	± 16.8	0.4364	0.0120	0.0503	0.0168
0.800	0.1177	± 2.9	-0.0147	± 9.8	0.5951	0.0109	0.0458	0.0130
1.000	0.1473	± 1.9	-0.0158	± 7.7	0.7453	0.0076	0.0338	0.0109
2.000	0.1837	± 0.6	-0.0127	± 3.9	0.9294	0.0000	0.0049	0.0014
3.000	0.1790	± 0.6	-0.0099	± 7.7	0.9053	-0.0001	0.0340	0.0044

Table S10 Measurements for $R_e = 7908$ at $x/h = 10$

y/h (-)	U (m s^{-1})	U error (%)	V (m s^{-1})	V error (%)	U/U_e (-)	$\langle -u'v' \rangle / U_e^2$ (-)	$\langle u'u' \rangle / U_e^2$ (-)	$\langle v'v' \rangle / U_e^2$ (-)
0.025	0.0109	± 5.8	-0.0002	± 27.6	0.0550	-0.0001	0.0020	0.0000
0.100	0.0546	± 3.3	-0.0004	± 104.8	0.2760	0.0005	0.0122	0.0024
0.200	0.0835	± 2.8	-0.0007	± 129.2	0.4224	0.0022	0.0214	0.0039
0.400	0.0958	± 2.3	-0.0026	± 47.9	0.4844	0.0040	0.0234	0.0071
0.600	0.1074	± 2.7	-0.0049	± 25.0	0.5432	0.0060	0.0300	0.0102
0.800	0.1255	± 2.2	-0.0056	± 21.7	0.6347	0.0071	0.0298	0.0082
1.000	0.1320	± 1.9	-0.0039	± 24.3	0.6674	0.0062	0.0274	0.0076
2.000	0.1673	± 0.9	-0.0055	± 11.1	0.8462	0.0007	0.0057	0.0019
3.000	0.1623	± 0.9	-0.0031	± 18.1	0.8208	0.0009	0.0367	0.0055

Table S11 Measurements for $Re = 7908$ at $x/h = 19$

y/h (-)	U ($m s^{-1}$)	U error (%)	V ($m s^{-1}$)	V error (%)	U/U_e (-)	$< -u'v' > / U_e^2$ (-)	$< u'u' > / U_e^2$ (-)	$< v'v' > / U_e^2$ (-)
0.025	0.0260	± 4.3	-0.0008	± 8.3	0.1314	0.0001	0.0043	0.0001
0.100	0.0918	± 2.3	0.0001	± 344.8	0.4645	0.0004	0.0118	0.0042
0.200	0.1080	± 1.9	-0.0004	± 127.5	0.5462	0.0010	0.0117	0.0015
0.400	0.1195	± 1.9	-0.0018	± 36.4	0.6045	0.0016	0.0150	0.0028
0.600	0.1263	± 1.7	-0.0023	± 34.6	0.6388	0.0021	0.0145	0.0044
0.800	0.1325	± 1.9	-0.0024	± 33.0	0.6702	0.0027	0.0157	0.0042
1.000	0.1366	± 1.6	-0.0018	± 46.1	0.6912	0.0030	0.0145	0.0043
2.000	0.1626	± 1.0	-0.0025	± 26.8	0.8226	0.0012	0.0074	0.0027
3.000	0.1651	± 0.5	-0.0019	± 33.1	0.8349	-0.0006	0.0272	0.0050

Figure S2 Example of a time series used to calculate the velocities for $Re = 7908$ at $x/h = 19$ and $y/h = 1$ Figure S3 Mean stream-wise velocity profiles for various Re at horizontal position $x/h = -3.12$