THREE-COMPONENT VELOCITY MEASUREMENTS IN A MOMENTUM-CONSERVING, AXISYMMETRIC, TURBULENT JET

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Abstract Experiments have been performed on a momentum conserving axisymmetric turbulent jet, the turbulence characteristics of which are well known [1]. Simultaneous three-component velocity measurements are acquired with high spatial and temporal resolution, using a new triple-sensor hotwire probe. Velocity and directional calibrations are performed using a dedicated automatic calibration system. Two experiments are performed; one for capturing the average velocity field in a 3D volume (Figure 1), and one for investigating the turbulence spectra in specific points in space (Figure 2). In the first experiment, measurements are performed in 9 equidistant cross-planes, from 10- to 50-diameters downstream of the nozzle using a computer-controlled traversing system. The spatial resolution is as low as 1 mm and the sampling rate was 10 kHz. In the second experiment, long velocity time histories are acquired with 50 kHz sampling rate to perform power spectral density computations for each velocity component. Preliminary results of velocity confirm the general characteristics of the turbulent jet. The power spectra at different positions indicate that the turbulent fluctuations are not isotropic at lower frequencies.

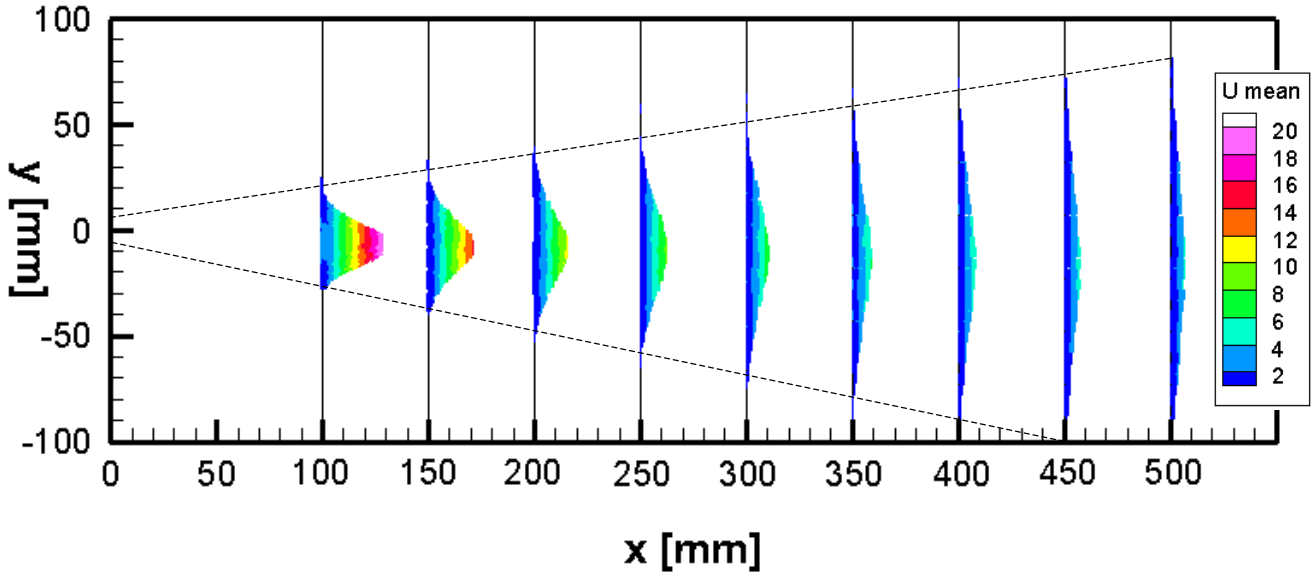

Figure 1. Evolution of the jet profile in the streamwise direction. The nozzle is located at x,y=0.

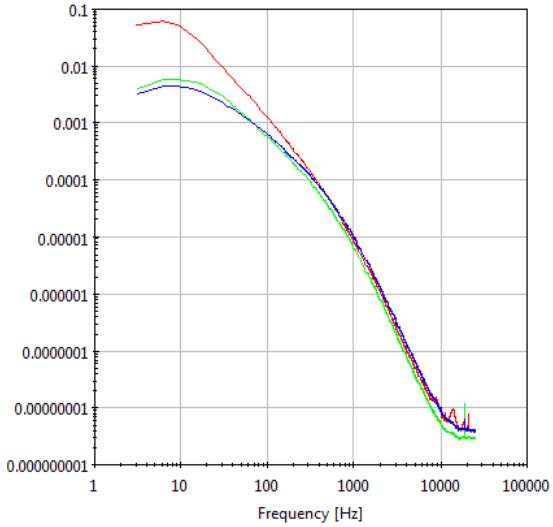

Figure 2. PSD for each velocity component (u-, v-, w-), at x=300mm and 42mm from the jet axis.

References

[1] H.J. Hussein, S.P. Capp, and W.K. George. Velocity measurements in a high-Reynolds-number, momentum-conserving, axisymmetric, turbulent jet. *J. Fluid Mech.* **258**: 31–75, 1994.