AERODYNAMIC CHARACTERIZATION OF COAXIAL JETS

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The configuration of two coaxial nozzles is widely used to mix two fluid streams in many engineering applications (e.g.: combustion chambers, jet pumps, mixing tanks, cooling systems and premixed burners), so that it is important to know the flow pattern of the coaxial jets in order to improve the design of all the possible applications in which it can be involved.

This work has focused on clarifying the flow pattern in the flow developing region of an air coaxial jet issuing into the surrounding calm air (Figure 1). One coaxial nozzle was tested for several inner jet velocities and velocity ratios r_V (ratio of the inner to outer jet velocity) under 1. Experiments were carried out using two techniques: hot wire probe and PIV (Figure 2).

It has been found a similarity in the fully merged zone between the single jet and coaxial jets for different velocity ratios under 1 (Figure 3) if defining a characteristic diameter D^* depending on r_V , obtained from a momentum balance. It has been also obtained the evolution of the inner (z_{p1}) and outer (z_{p2}) potential core lengths with r_V (Figure 4), as well as results concerning the radial evolution of velocity and turbulence intensity at different axial coordinates.

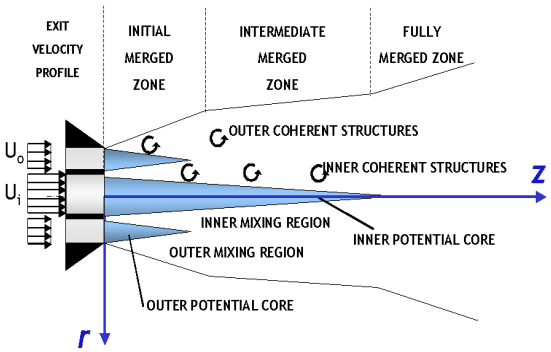

Figure 1: Sketch of a coaxial jet

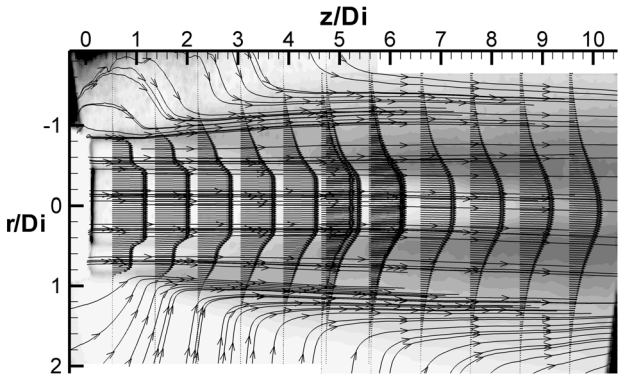

Figure 2: PIV plot U_i 60 m/s. Streamlines, velocity profiles and contour plot of RMS/U_i . D_i = inner jet diameter

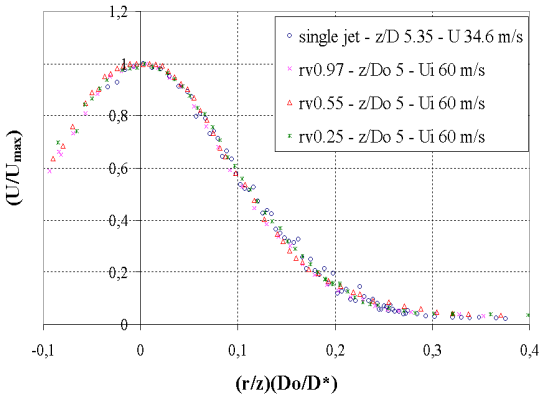

Figure 3: Similarity of coaxial jets with different velocity ratios in the fully merged zone. D_o = outer jet diameter

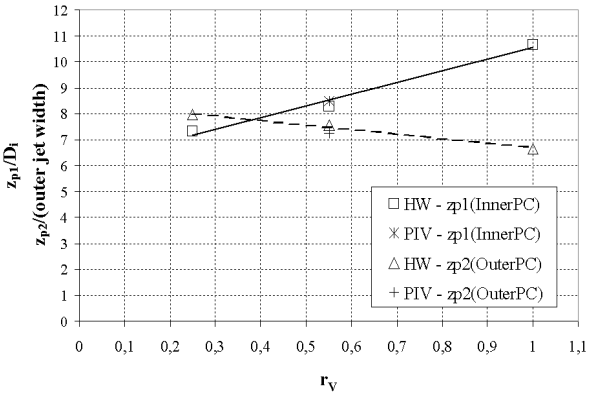

Figure 4: Evolution of Inner and Outer potential core lengths with the velocity ratio. U_i 60 m/s