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Mixing characteristics in the near-field of a swirling jet[1] RAMIS OERLUE, P. HENRIK ALFREDSSON, KTH Mechanics, Royal Institute of Technology, Stockholm, SWEDEN — Swirl is known to increase the spreading of turbulent jets. The purpose of the present work is to investigate the effect of rotation on the mixing characteristics of a passive scalar in the near-field of a turbulent swirling jet. Contrary to previous experiments, which leave traces of the swirl generating method especially in the near-field, the swirl was imparted by discharging a slightly heated air flow from an axially rotating and thermally insulated pipe (6 m long, diameter 60 mm). This gives well-defined axi-symmetric streamwise and azimuthal velocity distributions as well as a well-defined temperature profile. By means of a specially designed combined X-wire and cold-wire probe it was possible to simultaneously acquire the instantaneous axial and azimuthal velocity components as well as the temperature and hence their joint statistics. The comparison of the experiments performed at a Reynolds number of 24000 and a swirl number (ratio between the angular velocity of the pipe wall and the bulk velocity in the pipe) of 0.5 with those for the non-swirling jet clearly shows that the addition of swirl to the jet increases the spreading and radial heat transport. It is also shown that the streamwise velocity and temperature fluctuations are highly correlated.

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