Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Velocity and concentration fields in turbulent buoyant mixing in tilted tubes J. ZNAIEN, F. MOISY, J.P. HULIN, D. SALIN, FAST Laboratory, Bat 502, Campus Paris Sud, 91405 Orsay (France), E.J. HINCH, DAMTP-CMS, CB3-OWA, Cambridge (UK) — $2D$ PIV and LIF measurements have been performed on buoyancy driven flows of two miscible fluids of the same viscosity in a tube tilted at different angles θ from vertical and at different density contrasts (characterized by the Atwood number At). As θ increases and At decreases, the flow regime evolves, behind the front, from a turbulent shear flow towards a laminar counter flow with 3 layers of different concentrations. Time variations of the structure function show that both intermittent and developed turbulence occur in intermediate conditions. In the turbulent regime ($Re_\lambda \sim 60$) the magnitudes of the longitudinal $\overline{u'^2}$ and transverse $\overline{v'^2}$ velocity fluctuations and of the component $\overline{u'v'}$ of the Reynolds stress tensor are shown to be largest on the tube axis while viscous stresses is only important close to the walls. The analyzis of the momentum transfer in the flow with buoyancy forces estimated from the concentration gradients demonstrates that $3D$ effects are required to achieve the momentum balance. These results are discussed in the framework of classical turbulence models.

J. Znaien

Date submitted: 28 Jul 2008 Electronic form version 1.4