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Local concentration and velocity distribution for buoyancy driven mixing flows in long tubes at different tilt angles J. ZNAIEN, F. MOISY, D. SALIN, J.-P. HULIN, FAST Laboratory, CNRS, Pierre et Marie-Curie Paris 6 and Paris-Sud 11 Universities (France), E.J. HINCH, DAMTP-CMS, Cambridge University (UK) — The buoyancy driven mixing of two fluids of different densities (Atwood numbers $10^{-3} \leq At \leq 10^{-2}$) interpenetrating each other has been studied at the local scale in a 20mm diameter tube tilted at an angle $15^\circ \leq \theta \leq 60^\circ$ from vertical. The velocity and concentration maps are measured by means of PIV and LIF techniques in a vertical diametral plane. At large angles ($\theta = 45 - 60^\circ$) and low density contrast ($At = 10^{-3}$) the flow is laminar with three layers of different densities stabilized by transverse gravity. At high At ($4 \times 10^{-3} - 10^{-2}$) and low θ ($15^\circ - 30^\circ$), there is a turbulent shear mixing region with linear velocity and concentration transverse profiles in the middle of the tube section and with two channels of less mixed fluids at the top and bottom. The size of the channels increases at lower At and higher θ. The local viscous and turbulent momentum fluxes have been determined and their variation in the section and their dependence on θ will be discussed. At intermediate At and θ values, isolated or periodic turbulent bursts between which the flow returns to laminar are observed and both the velocity and concentration spatial correlations have been determined.

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