Heat convection in bubbly vertical convection and future plans

We present the result of vertical convection (Rayleigh Bénard on it's side) with bubble injection. Experimental measurements were performed with and without the injection of ≈ 2.5 mm diameter bubbles (corresponding to $\mathrm{Re}_b \approx 600$) in a rectangular water column heated from one side and cooled from the other. The Rayleigh number Ra_H is varied in the range 4.0×10^9–1.2×10^{11} and the gas volume fraction α was varied in the range 0%–5%. A 20-fold enhancement of heat transport has been found due to bubble injection. Interestingly, for bubbly flow, for our lowest concentration $\alpha = 0.5\%$ onwards, the Nusselt number $\overline{\mathrm{Nu}}$ is nearly independent of Ra_H, and depends solely on the gas volume fraction α. We observe the scaling $\overline{\mathrm{Nu}} \propto \alpha^{0.45}$, which is suggestive of a diffusive transport mechanism. Local measurements indicate an huge increase in temperature fluctuations. We also look at the effect of the location of the injection; either covering the full bottom or only parts of it. We find that the transport can be further enhanced by focusing the injection to a single side rather than throughout the entire bottom. Lastly I will also discuss future projects in the Twente Heat and Mass transfer tunnel.