Setup design and ground investigation for a microgravity experiment on bubble dynamics and coalescence

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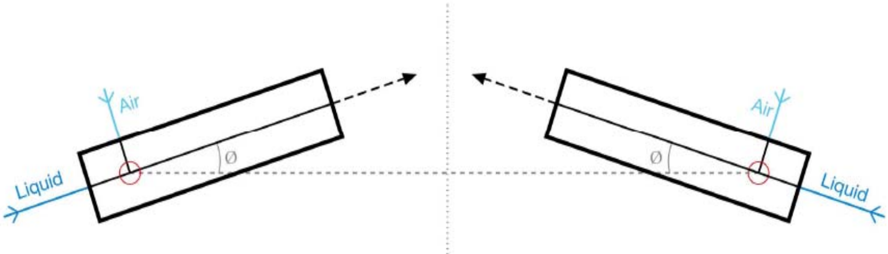
Biphasic flows in microgravity have become an active field of research in the last years. The substitution of liquid pumped loops by two-phase flows can give rise to a more effective thermal transport in space as well as weight and costs savings. Biphasic flows are present in several space applications such as propulsion systems, life support systems, power generation systems and cryogenic transfer and storage systems.

The knowledge of the distribution and size of the dispersed phase in a biphasic flow is essential in order to analyze the heat and mass transfer. Thus, a good understanding of the phenomena of bubble coalescence can give insight in the biphasic flow behavior and provide useful information for a better modelisation.

We have designed an experimental setup to study the dynamics and coalescence of bubbles in a microgravity environment for different incidence angles. Bubbles of controlled size and frequency are introduced in a cavity by means of two microchannel bubble injectors [1] which operate independently of the microgravity level. The relative orientation of both injectors is controlled externally by stepper motors, allowing them to lie one in front of the other or to describe angles up to 60º with the horizontal line (see figure). A Labview code controls the stepper motors, the liquid and gas pump and the data acquisition system, which is composed by accelerometers and temperature and pressure sensors. A high-speed camera records the bubble dynamics and coalescence phenomena.

Ground investigations have been carried out for different liquid and gas injection flow rates and several incidence angles. The behavior of the maximum distance reached by the bubbles in the direction of injection has been analysed. When only gas is injected, paths followed by the generated bubbles show different patterns when the relative orientation of the injectors is changed.



[1] J. Carrera, X. Ruiz, L. Ramírez-Piscina, J. Casademunt, M. Dreyer, *Generation of a Monodisperse Microbubble Jet in Microgravity,* preprint (2007).