# EXPERIMENTAL STUDY OF A 90$^{O}$ ELBOW BEND EFFECT IN A TWO-PHASE BUBBLY FLOW

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Two-phase flows are of typical occurrence in Industry, examples of it are the Oil, Chemical and Energy Power Production industries. In many cases it appears associated together with other phenomena as heat transfer, where the second phase emerges spontaneously in form of gas/vapor. The inclusion of an additional phase increases the complexity of flow behavior and in terms of practical effects it is responsible for an increasing in the pressure drop when compared with sing-phase flow.

In particular there is a great interest in the understanding of gas bubbly flows in pipe singularities such as convergence or divergence sections or bends, for which few correlations exist for predicting the associated pressure drop.

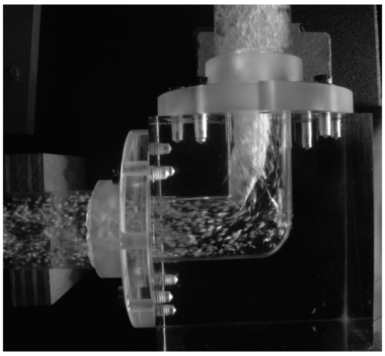

*Figure1: Top view of the bend*

To better understand the effect of an elbow bend in a gas-liquid bubbly flow an experimental study has been carried out in the horizontal branch of the VKI experimental facility LUCY II. The study includes the measurements of local flow parameters using a dual optical probe, namely the local void fraction distribution, the velocity and diameter of the gas bubbles, and the pressure change, using a pressure transducer type Validyne, for water flow rates of 2l/s and 2.5l/s and volumetric qualities of 5%, 10%, 15% and 20%. These measurement have been performed at different pipe sections located upstream and downstream the singularity. As a complement to this study flow visualization have also been done.

The local void fraction measurements show that the gas bubbles tend to be concentrated at the top of the pipe soon after the injection and this situation is preserved until the entrance of the bend. However after the bend the distribution is completely changed and the bubbles are totally dispersed in the entire pipe section. Downstream after the bend, the stratification process starts again and the same bubble distribution observed before the bend is retrieved. It is found that the bubble velocity is close to the superficial liquid velocity. It decreases when approaching the bend and increases after. The velocity profile just after the bend is uniform for all the cases studied. The vertical profile of the bubble Sauter mean diameter (SMD) is very similar to the profile of the void fraction; larger SMD-values are found at the top of the pipe section for profiles were the bubbles are "stratified".

Good agreement between measurements of static pressure variations and theoretical predictions is obtained for single and two-phase flow. The measured pressure losses due to the bend for two-phase flow have been compared with existing correlations. A correlation in terms of dimensionless pressure coefficient as function of the volumetric quality is proposed.