SLUG FLOW: Slug flow in horizontal pipes characterizes a wide range of liquid and gas flow rates and implies numerous problems. The slug flow is very complex and presents an unstable behavior. Velocity and pressure are peculiar but the predictions of other quantities such as the liquid hold-up, the transfer of heat or the drop pressure are challenging. The power, nuclear and chemical industries have great interest in multiphase flow study. Also petroleum industries are showing an increasing interest on this type of flow. Being able to handle multiphase flows would bring enormous economic benefits. Think of subsea wells that contain multiple phases, like oil, water and/or gas, whose composition is not known priori. Fluids inside long subsea network can change causing serious operational problems. Slug flow is characterized by a repetitive structure that moves along the pipe. The prediction of the slug frequency is a critical issue in developing slug flow model. There are many ways to characterize a slug flow making different measurements. It's possible to measure the pressure along tube, the slug velocity, the liquid height an so on. There are different techniques to measure slug velocity, for instance the cross-correlation of signals of consecutive sensors like resistive or capacitive probes is a common measurement technique. Velocity measurements could be carry also by image processing technique. It's very important to develop experimental setup that is the least intrusive possible.

EMULSIONS: In oil industry emulsions are very common. An emulsion is a mixture of two immiscible liquids. One liquid (disperse phase) is dispersed in the other (continuous phase). Two types of emulsion are readily distinguished, oil-dispersed-in-water (O/W) and water-dispersed-in-oil (W/O). However emulsion characterization is not always so simple and it is not unusual to encounter multiple emulsions, O/W/O, W/O/W, and even more complex type. Formation of emulsions during oil production is a costly problem, both in term of production lost and chemicals used. Anyway emulsions have the advantage of having a smaller viscosity than crude oil. This characteristic is very useful for transportation (see Shadi W. Hasan et al. 2010). Heavy oil is suspended as micro-spheres stabilized in a water continuous phase forming an O/W emulsion and thus achieving a reduction in the viscosity. The surfactant, used to create the emulsion, must be able to stabilize the emulsion during transportation but also must be capable of separation once the end of the pipeline is reached. Create emulsion with stable properties, such as stability and rheological characteristics, is very important. These properties depend on many variables like temperature and droplet size distribution. The highest level of control consists of creating mono disperse phase with tunable droplet mean size.