Masters project: 3D scanning of porous media flows – mobilization of trapped clusters

The investigation of porous media flows is a topic of pivotal importance for several aspects of human activity. The extraction of water from natural reservoirs, the remediation of contaminated soils and the recovery of oil from subsea rocks are two examples where the knowledge of porous media physics brings immediate economical and societal impact. Performing experiments in 3D systems in porous media is a challenging, as natural rocks and soils are never transparent. At the University of Oslo we have developed an innovative 3D scanning setup that allow us to see inside an artificial porous sample made of glass (https://titan.uio.no/teknologi-fysikk-goy-pa-laben-innovasjon/2020/splitter-ny-3d-skanner-folger-vaesker-fra-hulrom-til-hulrom). In this project you will have the opportunity to further develop the technique and to apply it to study how different fluids move inside a porous network. In particular, we will employ the setup to study how trapped clusters of a fluid can be washed away from the porous medium by using another fluid moving fast around the first one. This experimental project will give you useful transferable skills related to fluid mechanics, optics, experimental control and programming.

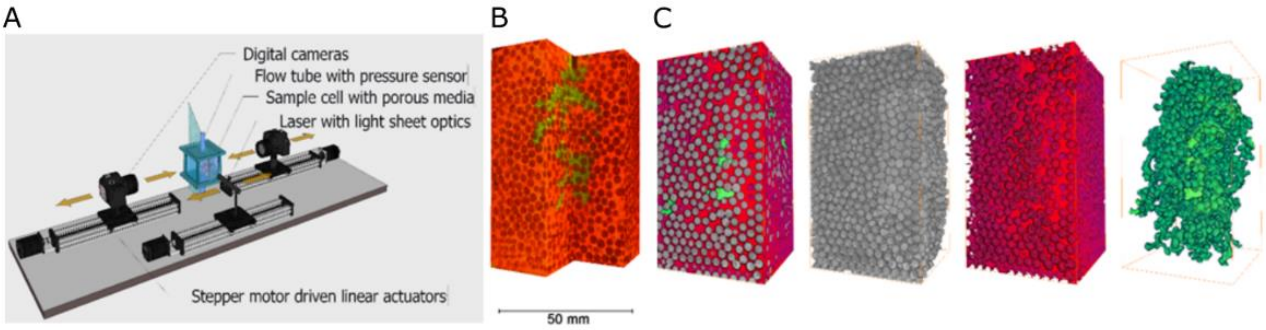

Figure: **A** The 3D scanner is based on optical index matching and fluorescence. A random packing of 3 mm glass beads forms the porous medium, index matched with two immiscible fluids. The fluids contain different fluorescent dyes that are excited with a 2D laser sheet that is driven through the sample during a scan. The fluid phases appear on the images with different colors, making them distinguishable through the analysis. **B** Raw 3D data. The 2D images captured as frames by the cameras are added together to build up the third dimension. **C** Segmented phases. The porous medium and the two liquid phases are fully separated.