

Mathematical modelling of wellbore pressure profiles in CSG wells

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Problem definition

The available models in CSG industry simulators were originally designed for conventional oil & gas wells (co-current two-phase flows). This project aims to develop models to predict the pressure profile in CSG wells (counter-current two-phase flows).

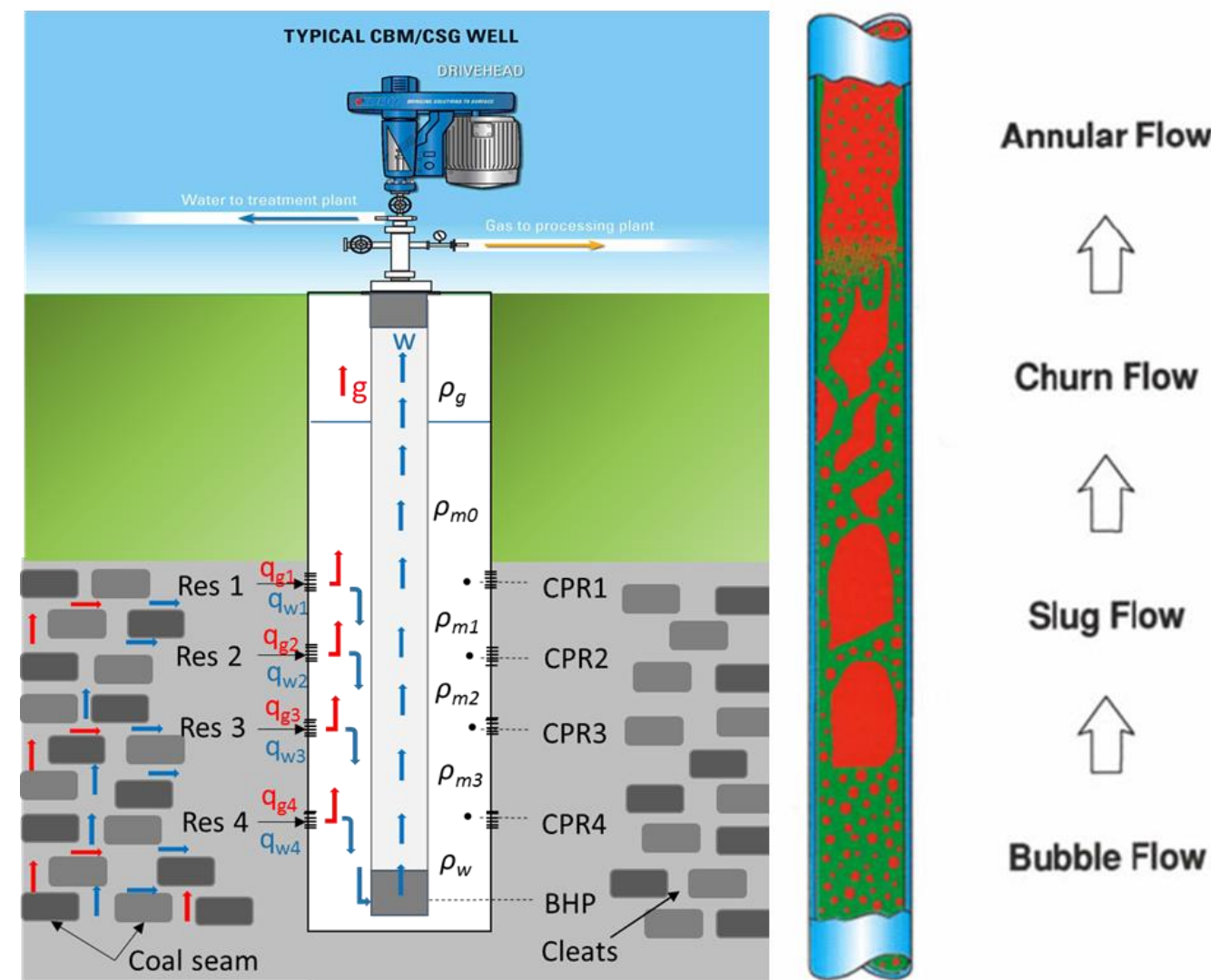


Figure 1. Schematic of a CSG well and varying flow regimes across the well

Project objectives

The objectives of this project are as follows:

1. Reviewing the available literature on two-phase flows in pipes and annuli
2. Conduct an experimental study to identify flow regimes and measure the pressure profile of counter-current two phase flows in annuli
3. Develop mechanistic models to predict flow regime transition and pressure gradients
4. Test the models predictions against our acquired experimental data as well as field data.

Results

Collating the published experimental flow map results allowed for an assessment of the known theoretically developed models for predicting flow regime transitions. Non-dimensional flow map solutions could also be tested.

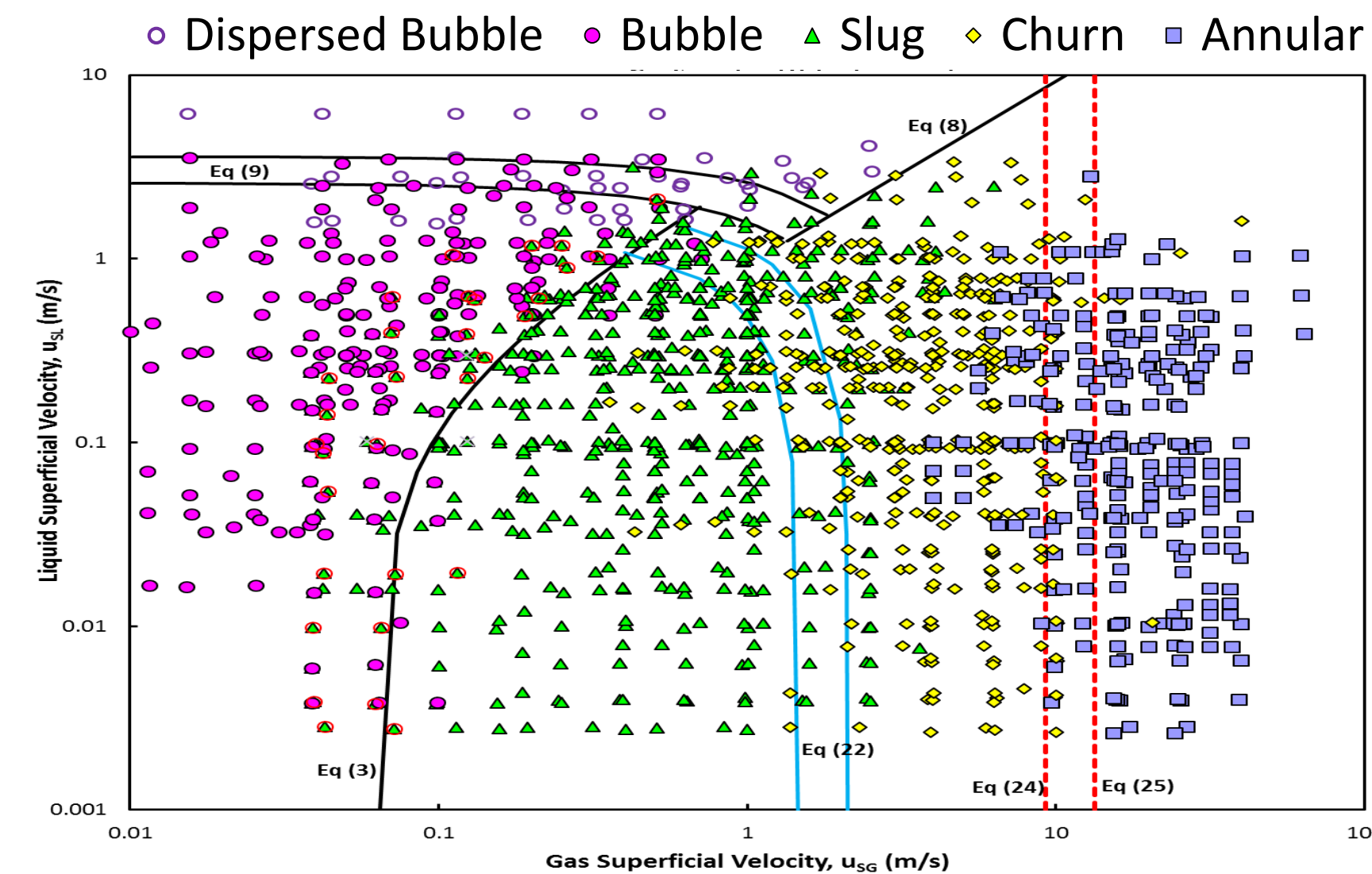


Figure 2. Validation of the models to predict the transition between flow regimes using experimental data of co-current upward flows in 12-67 mm I.D. vertical pipes

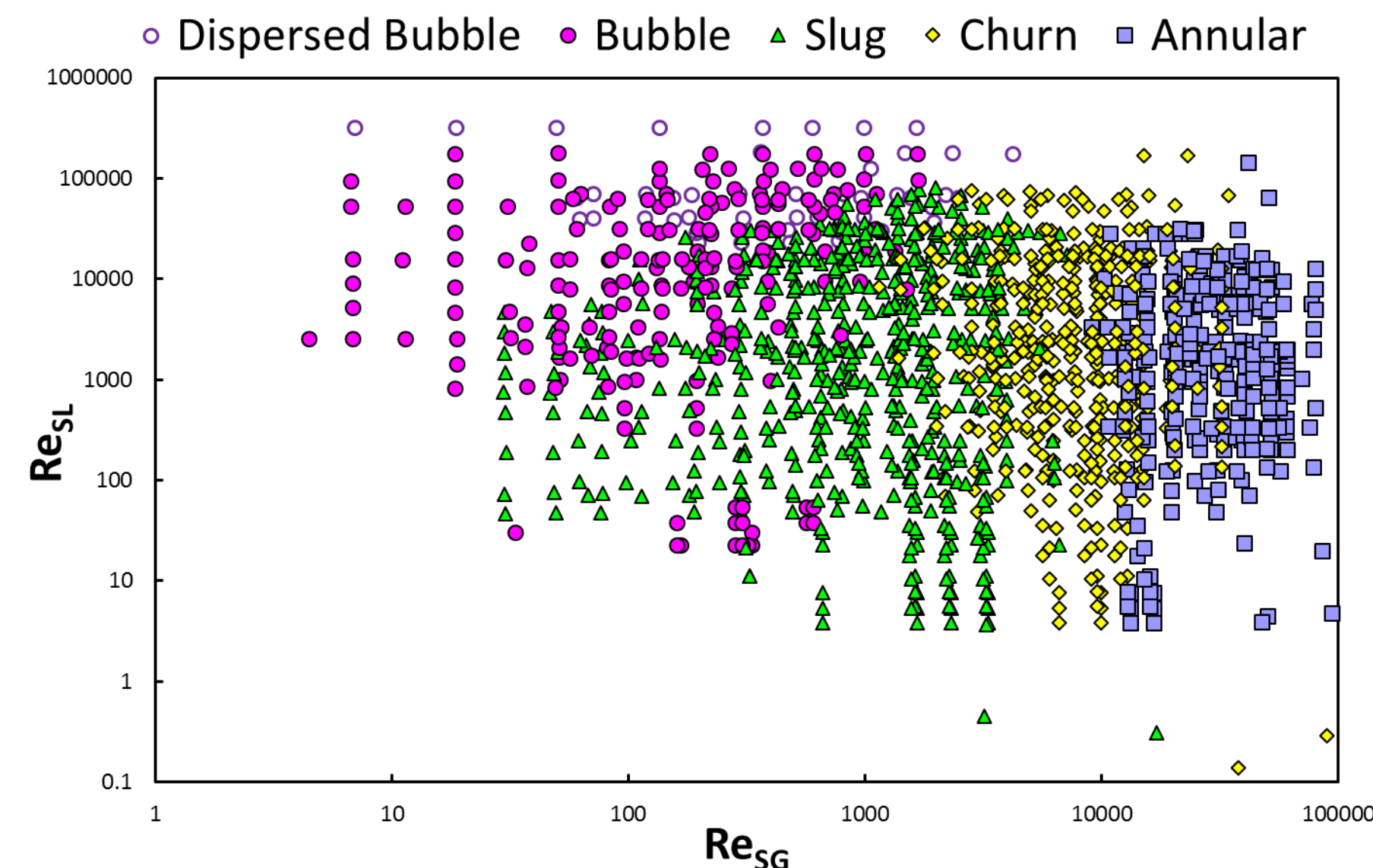


Figure 3. Non-dimensional flow map for co-current upward flow in vertical geometries

Modelling results

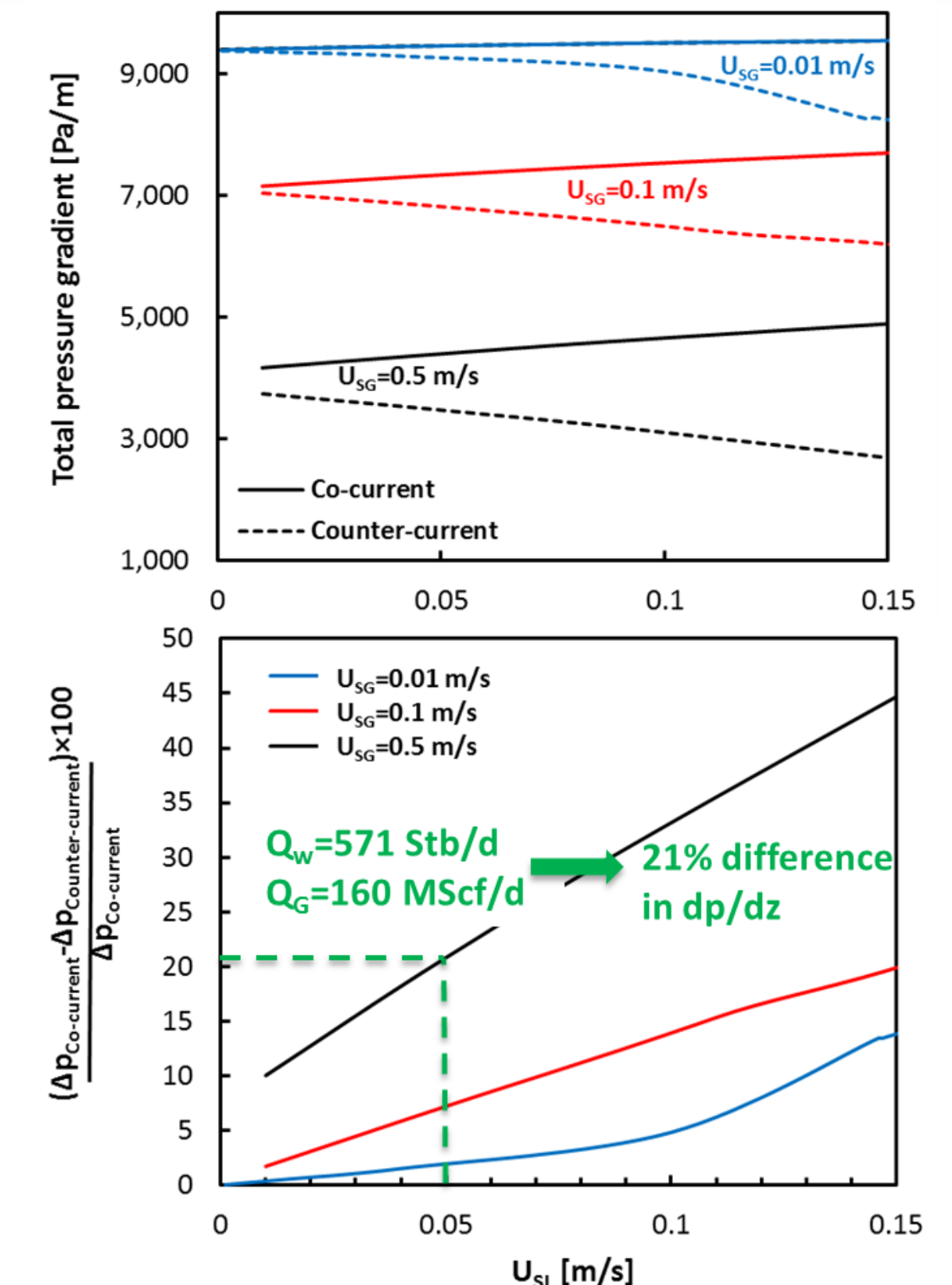


Figure 4. Predicted total pressure gradient for methane-water co-current and counter-current flows in an annulus (DC = 7 inch and DT = 2.87 inch)

Experimental setup

